

ROUTE SLIP

DEPARTMENT OF HEALTH & ENVIRONMENTAL SCIENCES

TO:

PROOF *ll*

DATE:

5/20/91

1.

Tony G

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Roger T

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Diane R

PhK

☒ Approval

☒ Comment

☐ Necessary Action

☐ Note and Return

☐ Note and File

☐ Investigate

☐ Prepare reply

☒ Signature

☐ See Me

☐ As requested

☒ For your information

☐ Per Conversation

REMARKS:

Mailed 5-23-91 ll

FROM:

Ralph Smith



File
Helena
L & C Co.

DEPARTMENT OF
HEALTH AND ENVIRONMENTAL SCIENCES

STAN STEPHENS, GOVERNOR

FAX #(406) 444-1499

STATE OF MONTANA

OFFICE 836 Front Street
LOCATION: Helena, Montana

MAILING Cogswell Building
ADDRESS: Helena, MT 59620

Solid & Hazardous Waste Bureau
Telephone: (406) 444-1430

May 20, 1991

City of Helena
Dick Nisbet, Director of Public Works
City/County Building
316 North Park Avenue
Helena, MT 59623

Dear Mr. Nisbet:

The purpose of this letter is to acknowledge receipt of the report from Hydrometrics, Inc. "A Proposed Work Plan for Hydrologic Monitoring and Landfill Closure Plans, City of Helena Landfill" received at this office on April 10, 1991. The proposed work plan overall is very good, however, there likely will be additional requirements necessary for proper closure of the City of Helena landfill before the Montana Department of Health and Environmental Sciences will approve the landfill closure plan.

MDHES strongly recommends that dedicated gas monitoring wells be installed at the City of Helena landfill in order to monitor methane and other gases which have the potential to impact public health and the environment. The main justification for these additional controls is due to the fact that the landfill is located in an urban area and because there exists a potential for further urban development at the site itself.

The groundwater monitoring plan is adequate at this time. However, based on comments from the reviewers of the "Draft Groundwater Monitoring Rules for Landfills in Montana" it appears that the section "16.14.711 Monitoring During Closure" may change significantly. The groundwater monitoring time frame appears likely to increase from "a minimum of two sampling episodes for Table 1 parameters prior to approving closure..." to "a minimum of two sampling episodes per year for five years..." This would likely affect your closure plans significantly and the impact won't actually be known until the "Draft Groundwater Monitoring Rules for Landfills in Montana" are official at the end of this summer. Your proposed closure plans should have clauses in it to allow for changes in state rules which may affect your compliance.

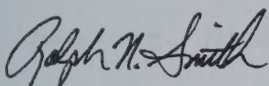
These are the main concerns at this time which are apparent in your proposed work plans. I look forward to reviewing your closure plan for the City of Helena landfill.

Page Two
City of Helena landfill letter
May 20, 1991

I've enclosed an additional copy of the "Class II Landfill Closure Guidance Policy" which explains requirements and recommendations for landfill closures which are currently being promulgated by DHES-Solid Waste Program. Also enclosed is a copy of the "Landfill Closure Review Sequence", a memo which outlines the procedure for obtaining state solid waste program approval of the landfill closure.

Thanks for your patience in waiting for this response. If you have any questions or concerns, don't hesitate to contact me.

Sincerely,



Ralph N. Smith
Solid Waste Program

Enclosures: "Class II Landfill Closure Guidance Policy" and
"Landfill Closure Review Sequence"

cc: Will Selser, City-County Health Department, City-County
Building, 316 North Park Ave., P.O. Box 1723, Helena, MT 59624

Randy Huffsmith, Hydrometrics, Inc., 2727 Airport Rd.,
Helena, MT 59601

DEPARTMENT OF
HEALTH AND ENVIRONMENTAL SCIENCES

File
L&C CO.
Helena
LF



STAN STEPHENS, GOVERNOR

FAX #(406) 444-1499

STATE OF MONTANA

OFFICE 836 Front Street
LOCATION: Helena, Montana

MAILING Cogswell Building
ADDRESS: Helena, MT 59620

Solid & Hazardous Waste Bureau
Telephone: (406) 444-1430

May 2, 1991

City of Helena
ATTN: Mr. Dick Nisbet, Public Works Director
City/County Building
316 North Park Avenue
Helena, MT 59623

Dear Mr. Nisbet:

The purpose of this letter is to acknowledge receipt of your consultant's (Hydrometrics, Inc.) letter on April 19, 1991 which presented their proposal to modify the City of Helena Landfill groundwater monitoring plan due to the potential for monitoring well HL-MW-1B (EPA-1) being compromised due to the fact the lock was missing. It seems appropriate to utilize this well HL-MW-1B (EPA-1) as a piezometer for future Helena Landfill groundwater monitoring. However, it would be appropriate to substitute another monitoring well as an upgradient monitoring well to determine if there are any impacts on the landfill system which could be attributed to upgradient influences.

Thanks for your timely attention to these concerns. If you have any questions or concerns, don't hesitate to contact me.

Sincerely,

A handwritten signature in cursive script that reads "Ralph N. Smith".

Ralph N. Smith
Environmental Specialist
Solid Waste Program

cc. Randy Huffsmith, Hydrometrics, Inc., 2727 Airport Rd., Helena,
MT 59601

Will Selser, Lewis & Clark City-County Environmental Health
Director, 316 North Park, Box 1723, Helena, MT 59624

Bill Verwolf, Helena City Manager, 316 North Park, Helena, MT
59624

RNS\rns

ROUTE SLIP

DEPARTMENT OF HEALTH & ENVIRONMENTAL SCIENCES

TO:

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| ☒ Approval | ☒ Comment | ☐ Necessary Action |
| ☐ Note and Return | ☐ Note and File | ☐ Investigate |
| ☐ Prepare reply | ☒ Signature | ☐ See Me |
| ☐ As requested | ☒ For your information | ☐ Per Conversation |

REMARKS:

Mailed
4-16-91 ll

FROM:

DEPARTMENT OF
HEALTH AND ENVIRONMENTAL SCIENCES

File
City of
Helena



STAN STEPHENS, GOVERNOR

FAX #(406) 444-1499

STATE OF MONTANA

OFFICE 836 Front Street
LOCATION: Helena, Montana

MAILING Cogswell Building
ADDRESS: Helena, MT 59620

Solid & Hazardous Waste Bureau
Telephone: (406) 444-1430

April 15, 1991

City of Helena
ATTN: Mr. Dick Nisbet, Public Works Director
City/County Building
316 North Park Avenue
Helena, MT 59623

Dear Mr. Nisbet:

I was informed by Mr. Steve Downn of Hydrometrics, Inc. that monitoring well "HL-MW-1B" had its lock missing. This well has been utilized in the past in the City of Helena landfill groundwater monitoring well network. On April 12, 1991 I examined monitoring well "HL-MW-1B" and other wells at the City of Helena landfill and this letter contains my observations and recommendations for this site.

Monitoring well "HL-MW-1B" had the flanges on the locking cap removed and the lock was missing. Consequently, there exists the possibility that this well may have been tampered with and the integrity of any groundwater test results from this well (HL-MW-1B) may be compromised. The potential data derived from this well is likely to be statistically invalid. It is recommended that monitoring well "HL-MW-1B" be removed from the list of wells utilized for the groundwater monitoring well network at the City of Helena Landfill. This well is also known as "EPA-1" in reports submitted by Hydrometrics, Inc. for their hydrogeologic investigations for their client, the City of Helena.

It may be prudent to utilize a different monitoring well for the purpose of monitoring the groundwater at this site. The decision as to what alternative monitoring point may be suitable is left to the City of Helena to determine. Please respond to these concerns by May 1, 1991.

If you would like to discuss these concerns in a meeting, then contact this office at your convenience.

If you have any questions or concerns, don't hesitate to contact me.

Sincerely,

A handwritten signature in cursive script that reads "Ralph N. Smith".

Ralph N. Smith
Environmental Specialist
Solid Waste Program

Page Two

City of Helena Landfill Groundwater Monitoring Letter

April 15, 1991

cc. Randy Huffsmith, Hydrometrics, Inc., 2727 Airport Rd., Helena, MT 59601

Will Selser, Lewis & Clark City-County Environmental Health Director,
316 North Park, Box 1723, Helena, MT 59624

Bill Verwolf, Helena City Manager, 316 North Park, Helena, MT 59624

RNS/rns

ROUTE SLIP

DEPARTMENT OF HEALTH & ENVIRONMENTAL SCIENCES

TO:

DATE:

4/5/91

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Tony G

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| ☒ Approval | ☐ Comment | ☐ Necessary Action |
| ☐ Note and Return | ☐ Note and File | ☐ Investigate |
| ☐ Prepare reply | ☒ Signature | ☐ See Me |
| ☐ As requested | ☐ For your information | ☐ Per Conversation |

REMARKS:

4-8-91
Approved per DM/ll
Encl. Class II LF Closure Reg. 8.

mailed 4-8-91

FROM:

Ralph

DEPARTMENT OF
HEALTH AND ENVIRONMENTAL SCIENCES

file
City of
Helena LF
L&C CO



STAN STEPHENS, GOVERNOR

FAX #(406) 444-1499

STATE OF MONTANA

OFFICE 836 Front Street
LOCATION: Helena, Montana

MAILING Cogswell Building
ADDRESS: Helena, MT 59620

Solid & Hazardous Waste Bureau
Telephone: (406) 444-1430

April 4, 1991

City of Helena Landfill
City of Helena
316 N. Park Ave.
Helena, MT 59623

To Whom it May Concern:

This letter contains the "Closure Guidance Policy" which defines the Class II landfill closure requirements and recommendations being promulgated by the DHES-Solid Waste Program. Groundwater monitoring systems are required for Class II landfills which served a geographic population of 5,000 people or more and that accepted household waste at any time after October 1, 1989. Groundwater monitoring is required for landfills that meet these criteria even if the landfill closes before Federal Environmental Protection Agency (EPA) "Subtitle-D" requirements take effect. This is a provision of the "Montana Solid Waste Management Act", Section 75-10-207, MCA. If you would like a copy of the "Draft Groundwater Monitoring Rules" which define these potential additional closure requirements, please don't hesitate to contact this office for this information.

The "Closure Guidance Policy" should be self-explanatory but if you have any questions or concerns, or if I may be of additional service, please contact me.

Sincerely,

A handwritten signature in cursive script that reads "Ralph N. Smith".

Ralph N. Smith
Environmental Specialist
Solid Waste Program

Enclosure

RNS/rns

ROUTE SLIP

DEPARTMENT OF HEALTH & ENVIRONMENTAL SCIENCES

TO:

DATE:

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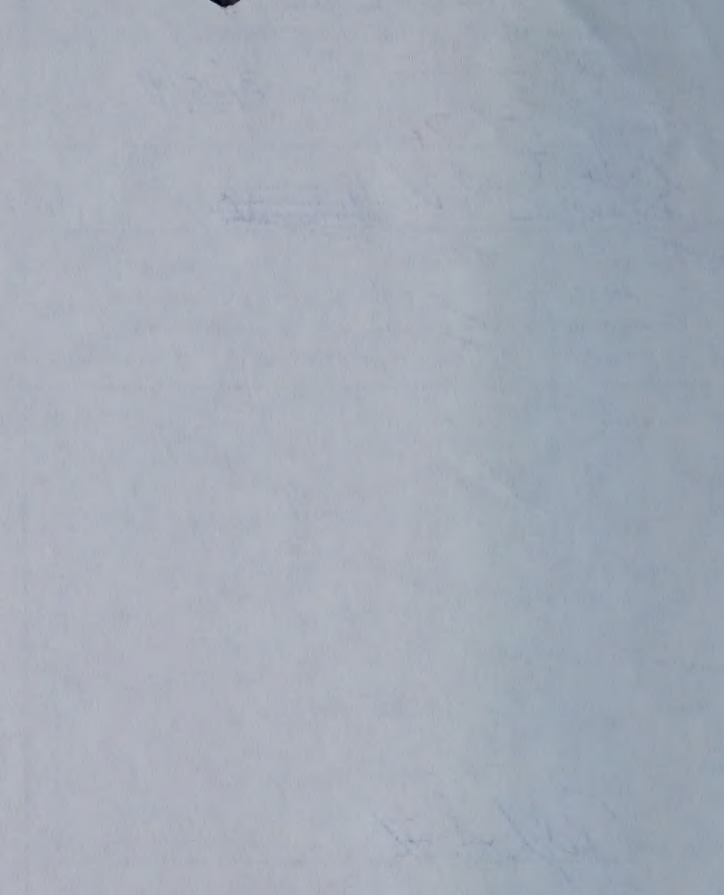
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REMARKS:

FROM:



DEPARTMENT OF
HEALTH AND ENVIRONMENTAL SCIENCES

file
City of
Helena LF



STAN STEPHENS, GOVERNOR

FAX #(406) 444-1499

STATE OF MONTANA

OFFICE 836 Front Street
LOCATION: Helena, Montana

MAILING Cogswell Building
ADDRESS: Helena, MT 59620

Solid & Hazardous Waste Bureau
Telephone: (406) 444-1430

March 25, 1991

Mr. Richard Nisbet
Director of Public Works-Helena
316 N. Park Street
Helena, MT 59623

Dear Mr. Nisbet:

This letter is in response to Will Selser's February 7, 1991 letter received at this office on February 8, 1991 defining additional sampling locations and procedures for the City of Helena Landfill to implement in their groundwater monitoring plan. The elements of Mr. Selser's letter include the following "recommendations for the proposed water quality analytical schedule for the Helena City Landfill.

(1) Well #59 should be added to the list. The public water well serving the trailer court at the Green Meadow/Custer intersection should also be sampled.

(2) The Spring sample should occur as near to the maximum low water period as possible. Mr. Botz indicated March was a good time.

(3) The storm drain ending at the North side of the Landfill should be extended to remove it as a source of water infiltration."

The parameters to be analyzed will include the entire Table 1 parameters listed in the draft groundwater monitoring rules for landfills in Montana. These parameters are required for all existing Class II landfills in Montana which serve more than 5,000 people in a geographic region.

The Solid & Hazardous Waste Bureau has the responsibility for regulation of groundwater monitoring for landfills in addition to local government agencies. These recommendations are very good and the state agrees with these plans.

I talked to Charles Hanson, City of Helena-City Engineer, on March 25, 1991 to determine if the storm drain beneath Front Street

Page 2

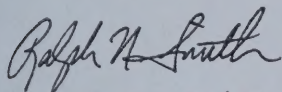
City of Helena Landfill Groundwater Monitoring Concerns
March 25, 1991

had been retro-fitted to extend beyond the landfill boundaries in order to reduce its potential as a source of water infiltration to the landfill. Mr. Hanson said the storm drain concern would be addressed in the final closure plan for the City of Helena landfill, which has not been submitted yet. It would be prudent to have copies of the project specifications for retro-fitting of the storm drain "to back-up the job intent" for state & city-county health department files.

These additional sampling concerns should be incorporated into the semi-annual sampling & analysis plan, and then in the annual report by Hydrometrics, Inc. which will assimilate the information and interpret the findings.

If you have any questions or concerns, please contact me.

Sincerely,



Ralph N. Smith
Environmental Specialist
Solid Waste Program

cc. Bill Verwolf, City Manager-Helena, 316 N. Park Ave,
Helena, MT 59623

Will I. Selser, Director-Environmental Health Division,
Lewis and Clark City-County Health Department, City-County
Building, 316 North Park, Box 1723, Helena, MT 59624

Randy Huffsmith, Hydrometrics, Inc., 2727 Airport Rd, Helena,
MT 59601

RNS/rns

DEPARTMENT OF
HEALTH AND ENVIRONMENTAL SCIENCES



STAN STEPHENS, GOVERNOR

COGSWELL BUILDING

STATE OF MONTANA

FAX # (406) 444-2606

Solid & Hazardous Waste Bureau

Telephone: (406) 444-2821

HELENA, MONTANA 59620

August 30, 1989

Hon. Russell Ritter, Mayor
City of Helena
31 N. Park Ave.
Helena, MT 59623

Re: Groundwater Monitoring and Landfill Site Closure

Dear Mayor Ritter:

As you are aware, the City of Helena is responsible for providing groundwater monitoring at the city landfill site. Since 1982, the city has checked groundwater to measure any release of contaminants from the buried waste at the site. In addition to the city's monitoring, a Federal Investigation Team ("FIT" Team) has monitored the site twice, once in 1987 and once this last winter.

Results from both the city's sampling and the FIT team sampling have revealed that the City of Helena landfill appears to be impacting groundwater to some degree. The sampling by the city has shown some levels of inorganic chemical parameters in groundwater beneath the landfill. Periodically, the monitoring also has revealed some "slugs" of contamination which may be related to the municipal sewer line which passes beneath portions of the landfill site.

The FIT team reports identify some potential releases of organic chemicals, including tetrachloroethane (PCE) and chloroform, and recommends that some further work is necessary to identify the extent of the contamination and to determine whether or not the contamination noted is from the landfill site itself, or from other sources. In the case of the PCE, the level of contamination is significant.

While the city has continued to pull samples and have tests made, no professional evaluations have been performed on the data for some time, and there are several things which need to be done at this time to improve and expand the city's monitoring program. We are requesting that the city

arrange for the following on the schedule I will mention later in this letter:

1) The city must obtain the services of a qualified groundwater consultant to evaluate the monitoring data and draw conclusions about the impact of the landfill on groundwater. The consultant's report must address:

a) The quality of groundwater both "upstream" and "downstream" of the landfill site.

b) The nature of any contamination emanating from the landfill site, including the concentrations of contaminants and the lateral and vertical extent of any contamination "plume".

c) An assessment of the adequacy of the existing monitoring program, including the number and quality of monitoring points, the frequency of sampling and the parameters being measured.

d) Recommendations for continued monitoring as appropriate.

e) Recommendations for any remedial or clean up work necessary to either remove, contain or minimize contamination as necessary.

f) If required, a survey of potentially impacted water supplies and a risk assessment addressing the public health and environmental implications of any contamination.

g) Other details of groundwater monitoring as appropriate.

2) The city must prepare a plan addressing the consultant's recommendations and submit it to this agency for approval.

Since recent events have made it clear that groundwater may be at higher elevations than predicted beneath parts of the landfill site, the need for prompt evaluation and action has increased. Remediation of any effects from the landfill will very likely include specific closure requirements implemented as the landfill is being closed. Since the date of closure is drawing near, it is important to "plan" this in conjunction with the monitoring evaluation. I would recommend that the city consider obtaining the services of a professional engineering consultant as well as the hydrogeological firm to develop a "closure plan" addressing both physical closure of the landfill and groundwater monitoring/action as appropriate.

Due to the fact that the site appears to be having impact upon groundwater at the current time, we request the following:

1) A groundwater assessment must be prepared as specified and provided for our review no later than January 1, 1990.

2) Any remedial action required must be implemented as recommended by the assessment within reasonable times to be specified after our review.

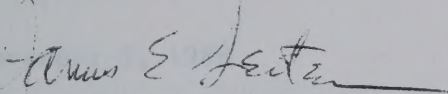
We also request that the city notify us when consultant/consultants have been retained and provide us copies of proposals, contracts, scopes-of-work,

reports, etc. as appropriate.

We would be happy to assist the city or your consultants in any way possible in the performance of these requirements. Please contact us if you have any questions or we may be of further service.

We would appreciate your written acknowledgement that the city agrees to the terms of this letter and will attempt to meet the time limits imposed.

Sincerely,


James E. Leiter, R.S.

cc: Dick Nisbet, DPW, City of Helena
Will Selser, L&C County Health Department
John Arrigo, WQB
Carol Fox, SHWB

DEPARTMENT OF HEALTH AND ENVIRONMENTAL SCIENCES



TED SCHWINDEN, GOVERNOR

COGSWELL BUILDING

STATE OF MONTANA

Solid & Hazardous Waste Bureau
Telephone: (406) 444-2821

HELENA, MONTANA 59620

November 3, 1988

Willie Miller
City of Helena
City-County Building
Helena, MT 59601

Dear Willie:

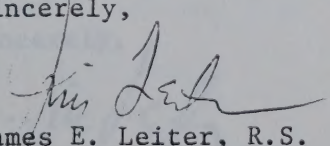
Thanks for visiting with me about Helena's groundwater monitoring system. I have enclosed a copy of our file record of monitoring that I have been keeping on our word processor. Keep in mind that these are my own file notes and observations and may not be technically accurate. The sample records are taken from the information that I've obtained from the city.

I also understand that the Federal Investigation Team (F.I.T.) is still planning to return for some more investigation at the Helena landfill very soon. Their proposal is to add a couple more monitoring wells. These might work very well into your overall monitoring plan.

As we discussed, the twice yearly monitoring program is a requirement of Helena's landfill license and the monitoring schedule needs to be rigidly observed unless the department authorizes a change in the program. It is important to get the sampling back on track again. It is also important to have an evaluation of the sampling results on a regular basis. The raw sampling data, without the benefit of a professional hydrogeological evaluation, is not very useful. I would recommend that the city obtain the services of a qualified consultant to perform the monitoring and prepare regular reports. I would further recommend that the city plan to attempt to keep the same consultant on retainer as long as possible in order to provide credence to the sampling results and interpretations.

Please let me know how I may be of assistance to your solid waste program. If you have any questions or I may be of service, please contact me.

Sincerely,


James E. Leiter, R.S.

cc: Will Selser, Lewis & Clark County Health Department

DEPARTMENT OF HEALTH AND ENVIRONMENTAL SCIENCES



TED SCHWINDEN, GOVERNOR

COGSWELL BUILDING

STATE OF MONTANA

Solid & Hazardous Waste Bureau
Telephone: (406) 444-2821

HELENA, MONTANA 59620

October 17, 1988

Dick Nisbet, DPW
City-County Administration Bldg.
316 North Park
Helena, MT 59623

Dear Dick:

As you are aware, the conditions of your Solid Waste Management System license for the Helena Landfill include semi-annual groundwater monitoring of well locations as approved by this department. The last sample results we have on record for your landfill are from June 15, 1987. Since that time, two monitoring events were to have taken place. We would appreciate a written acknowledgement that your monitoring program is proceeding as specified in your license conditions.

In addition to the above, some of the monitoring points at the landfill are no longer useable, and, as we discussed in relation to the reseeding of the soccer field areas, some of the points may no longer be the best available for assessing the overall impact of the landfill on groundwater in the area. For this reason, we feel it is appropriate to ask that the city obtain the services of a qualified consultant to evaluate the following:

- 1) Adequacy of the current monitoring network, including locations of existing wells, number of sample points, etc.
- 2) Adequacy of current monitoring parameters.
- 3) Adequacy of current monitoring schedule.
- 4) Assessment of the current impact of the landfill on area ground or surface water supplies.
- 5) Needed changes to the monitoring program.

We request that you arrange for these services and let us know who has been retained and on what schedule the services will be provided.

If you have any questions or we may be of assistance, please contact us.

Sincerely,

A handwritten signature in dark ink, appearing to read "James E. Leiter".

James E. Leiter, R.S.

cc: Will Selser, City-County Health Department
Ted Hill, City of Helena

DEPARTMENT OF HEALTH AND ENVIRONMENTAL SCIENCES



TED SCHWINDEN, GOVERNOR

COGSWELL BUILDING

STATE OF MONTANA

Solid & Hazardous Waste Bureau
Telephone: (406) 444-2821

HELENA, MONTANA 59620

August 1, 1988

Dick Nisbet, DPW
City of Helena
316 North Park Street
Helena, MT 59601

Dear Dick:

I have enclosed a copy of my May 20, 1988 letter to you. We have not yet received a response, and as I mentioned before, our last monitoring records are over one year old.

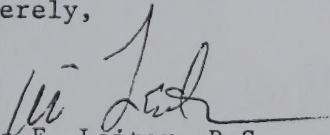
Semi-annual groundwater monitoring is a requirement of your solid waste management system license and a condition of your approval for use of the current landfill area. Due to staffing limitations we simply cannot send reminders to license holders each time monitoring results are due, and I note that for several years, we have had to send reminder letters each time. The City of Helena must be responsible to see that the testing is completed and the information from the tests is submitted without waiting for reminder letters.

Please send us copies of any monitoring results since June, 1987, or update us on the status of your current monitoring program.

In the future, we would appreciate it if you would notify all appropriate City of Helena personnel when the samples must be taken and make sure that the results are sent to this office on a timely basis.

If you have any questions, please contact this office.

Sincerely,


James E. Leiter, R.S.

cc: Will Selser
Ted Hill

DEPARTMENT OF HEALTH AND ENVIRONMENTAL SCIENCES



TED SCHWINDEN, GOVERNOR

COGSWELL BUILDING

STATE OF MONTANA

Solid & Hazardous Waste Bureau

Telephone: (406) 444-2821

HELENA, MONTANA 59620

May 20, 1988

Dick Nisbet, D.P.W.
City of Helena
City-County Administration Building
Helena, Montana 59601

Dear Dick:

In reviewing records for the Helena Landfill, I note that we have not received copies of groundwater monitoring records for September, 1987. Would you please forward a copy to me?

Please include us on the distribution list for copies of these records after the June samples are taken and in the future. Twice yearly groundwater monitoring is a requirement of your solid waste management license and we need to keep our files up to date.

I would also appreciate a copy of any gas monitoring results from June, 1986 on.

Thanks for your cooperation. If you have any questions or we may be of assistance, please contact us.

Sincerely,

A handwritten signature in cursive script, appearing to read "James E. Leiter".

James E. Leiter, R.S.

cc: Will Selser, Lewis & Clark County Health Dept.

DEPARTMENT OF HEALTH AND ENVIRONMENTAL SCIENCES



TED SCHWINDEN, GOVERNOR

COGSWELL BUILDING

STATE OF MONTANA

HELENA, MONTANA 59620

Solid & Hazardous Waste Bureau
(406) 444-2821

September 15, 1987

Dick Nisbet, DPW
City of Helena
City-County Administration Building
Helena, Montana 59601

Dear Dick:

I note from our file that we have not received monitoring results from the Helena landfill since September, 1986. We would appreciate it very much if you could forward the results of sampling conducted after that time to this office. If there is a delay in processing or some other problem we should be aware of, please let us know.

Thanks for your cooperation. If you have questions or we may be of any assistance to your solid waste program, please contact us.

Sincerely,

A handwritten signature in dark ink, appearing to read "James E. Leiter".

James E. Leiter

cc: Lewis & Clark County Health Dept.

DEPARTMENT OF HEALTH AND ENVIRONMENTAL SCIENCES



TED SCHWINDEN, GOVERNOR

COGSWELL BUILDING

STATE OF MONTANA

Solid & Hazardous Waste Bureau
(406) 444-2821

HELENA, MONTANA 59620

March 25, 1986

Mark Weston
City Sanitation/Wastewater Engineer
City of Helena
316 North Park Avenue
Helena, MT 59623

Dear Mark:

I have finally had a chance to review our records of groundwater monitoring at the Helena municipal landfill. We haven't received groundwater quality reports since October, 1984 and the last reported water level measurements were taken in November, 1984.

Semi-annual groundwater quality monitoring and water level measurement have been a requirement of the landfill license since the city requested approval for expansion into the current active area.

We are interested in knowing the current status of your monitoring program and need copies of any sampling results which have been gathered since November, 1984.

My guess is that the City's monitoring program has laid dormant due to the large turnover of personnel who used to do the sampling, both in your department and ours. Perhaps we should get together to update both sets of records and modify the program as appropriate.

Let me know what you'd like to do.

Sincerely,

A handwritten signature in cursive script, appearing to read "J. Leiter".

James E. Leiter
Solid & Hazardous Waste Bureau

cc: Dick Nisbet, D.P.W., City of Helena
Joan Miles, Lewis & Clark County Health Department

DEPARTMENT OF HEALTH AND ENVIRONMENTAL SCIENCES



TED SCHWINDEN, GOVERNOR

COGSWELL BUILDING

STATE OF MONTANA

(406)444-2821

HELENA, MONTANA 59620

September 5, 1984

Larry Longfellow
Helena Wastewater Treatment Plant
Custer Ave.
Helena, MT 59601

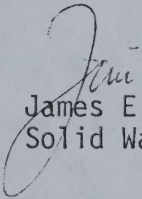
Dear Larry:

Here are two copies of the monitoring requirements for the landfill wells. I included a copy for Carol, also. As we discussed, since semi-annual quality samples are required at the landfill, the sludge site, and the wells surrounding the sludge site, they could all be taken about the same time, which might make scheduling a lot easier.

After the first year or so of water level samples at the landfill, we'll adjust the frequency to correspond with the quality samples.

Let me know if we can help in any way.

Sincerely,


James E. Leiter
Solid Waste Management Bureau

jg

Enclosures

Hydrometrics, Inc.



2727 Airport Road • Helena, Montana 59601 • (406) 443-4150 • FAX (406) 443-4155

May 10, 1991

Ralph N. Smith
Environmental Specialist
Solid Waste Program
Department of Health and
Environmental Sciences
Cogswell Building
Capitol Station
Helena, MT 59620

Linda,
Please file in
the City of Helena LF
Groundwater Monitoring
File.

Dear Mr. Smith:

This letter is in response to your letter to Mr. Dick Nisbet dated May 2, 1991. Hydrometrics, Inc. suggests substituting monitoring well EPA-3 for monitoring well EPA-1. EPA-3 is located south of EPA-1 about 700 feet, and would supply upgradient water quality data as you requested. Monitoring well 83-6 is also an upgradient well which is included in the routine monitoring schedule. Hydrometrics feels it would be prudent to sample both wells for spring and fall sampling in 1991 and then evaluate, based on the data obtained, whether or not both upgradient wells will need to be sampled on a semiannual basis.

If you have any questions or concerns, please contact Randy Huffsmith or myself.

Sincerely,

Steven K. Downs
Hydrogeologist

\skd

c: Dick Nisbet - Director of Public Works, City of Helena

RECEIVED

MAY 13 1991

Montana Department of Health
and Environmental Sciences
Solid and Hazardous Waste Bureau

Hydrometrics, Inc.

2727 Airport Road • Helena, Montana 59601 • (406) 443-4150 • FAX (406) 443-4155

*File: Lewis & Clark
City of Helena*

Mr. Ralph Smith
Environmental Specialist
Solid and Hazardous Waste Bureau
Cogswell Building
Helena, MT 59620

RECEIVED

APR 19 1991

Montana Department of Health
and Environmental Sciences
Solid and Hazardous Waste Bureau

Dear Mr. Smith

This letter is to address your concerns discussed in your letter to Dick Nisbet dated April 15, 1991 pertaining to the missing lock on monitoring well HL-MW-1B (EPA-1). It should be noted that this well is an EPA well and does not belong to the City of Helena. All City of Helena wells were fitted with locking caps and locked and to Hydrometrics' knowledge none have been compromised.

When Hydrometrics visited this well (EPA-1) on April 5, 1991, the lock was missing, however, two bolts attaching the well cap to the casing were in place and were tight. Hydrometrics agrees that the integrity of this well may have been compromised and that the well should be used only as a piezometer for ongoing Helena Landfill monitoring. Due to the number and location of wells on the routine Helena Landfill monitoring schedule, a replacement well for EPA-1 is not deemed necessary.

Several other wells drilled and owned by the EPA in the area are not a part of the Helena Landfill routine monitoring schedule and consequently have not been recently visited by Hydrometrics. It may be prudent to examine these wells to ensure their integrity as well.

If you have any questions or other concerns pertaining to this matter please call Randy Huffsmith or myself.

Sincerely,

Steve Downs

Steve Downs
Hydrogeologist

cc. Mr. Dick Nisbet
Will Selser
Bill Verwolf

City of Helena Public Works Director
Lewis & Clark Cnty. Environmental Health Director
Helena City Manager



LEWIS AND CLARK

CITY-COUNTY HEALTH DEPARTMENT

City-County Building
316 North Park
Box 1723
Helena, Montana 59624
Telephone 406/443-1010

February 7, 1991

RECEIVED

FEB 8 1991

Tony Grover, Solid Waste Program Manager
Solid and Hazardous Waste Bureau
MDHES
836 Front Street
Helena, MT 59601

MONTANA DEPARTMENT OF HEALTH
AND ENVIRONMENTAL SCIENCES
SOLID & HAZARDOUS WASTE BUREAU

Re: Monitoring VOC's at City of Helena Landfill

Dear Tony:

Here are my recommendations for the proposed water quality analytical schedule for the Helena City Landfill.

- (1) Well #59 should be added to the list. The public water well serving the trailer court at the Green Meadow/Custer intersection should also be sampled.
- (2) The Spring sample should occur as near to the maximum low water period as possible. Mr. Botz indicated March was a good time.
- (3) The storm drain ending at the North side of the Landfill should be extended to remove it as a source of water infiltration.

After the meeting yesterday, Dave Marshall, our Landfill Supervisor, talked with Randy Huffsmith. Randy stated that the numbers on Exhibit 2 of the report represent a time period from 11/89 to 5/90. This coupled with the fact the most current date is over 7 months old makes the picture very unclear. Sampling of sufficient numbers of wells; over a short time period; matched to the low water periods will give a much more accurate picture of the potential landfill water quality impact.

Anything less than this will not give the City or the homeowners downgradient fair knowledge of the existence or extent of VOC movement from the landfill.

Sincerely,

Will I. Selser, Director
Environmental Health Division

WIS/jm

(W)CHLF.VOC

RECEIVED

FEB 8 1991

MONTANA DEPARTMENT OF HEALTH
AND ENVIRONMENTAL SCIENCES
SOLID & HAZARDOUS WASTE BUREAU

CLERK OF DISTRICT COURT
JANUARY 1991
JANUARY 1991
JANUARY 1991
JANUARY 1991

RECEIVED

February 7, 1991

FEB 7 1991

MONTANA DEPARTMENT OF HEALTH
AND ENVIRONMENTAL SCIENCES
SOLID & HAZARDOUS WASTE BUREAU

TO: TONY GROVER, Solid Waste Program Manager
Solid and Hazardous Waste Bureau
HUNTER
836 Front Street
Helena, MT 59601

Re: Monitoring VOC's at City of Helena Landfill

Dear Tony:

Here are my recommendations for the proposed water quality analytical schedule for the Helena City Landfill.

(1) Well #29 should be added to the list. The public water well serving the trailer court at the Green Meadow Center intersection should also be sampled.

(2) The Spring sample should occur as near to the maximum low water period as possible. Mr. Goff indicated March was a good time.

(3) The storm drain ending at the North side of the Landfill should be extended to remove it as a source of water infiltration.

After the meeting yesterday, Dave Marshall, our Landfill Supervisor, talked with Randy Kuttanich. Randy stated that the numbers on Exhibit 2 of the report represent a time period from 1985 to 1990. This coupled with the fact the most current data is over 7 months old makes the picture very unclear. Sampling at sufficient numbers of wells over a short time period, matched to the low water periods will give a much more accurate picture of the potential landfill water quality impact.

Anything less than this will not give the City or the responsible developer fair knowledge of the existence or extent of VOC movement from the landfill.

Sincerely,

RECEIVED

FEB 9 1991

MONTANA DEPARTMENT OF HEALTH
AND ENVIRONMENTAL SCIENCES
SOLID & HAZARDOUS WASTE BUREAU

WILL I. SEILER, Director
Environmental Health Division

WISVJM

WISVJM.VOC



LEWIS AND CLARK

CITY-COUNTY HEALTH DEPARTMENT

City-County Building
316 North Park
Box 1723
Helena, Montana 59624
Telephone 406/443-1010

December 31, 1990

Tony Grover
Solid and Hazardous Waste Bureau
MDHES
Cogswell Building
Helena, MT 59620

Re: Groundwater Monitoring - City of Helena Landfill

Dear Tony:

Please let me know what, if any, action has been taken by the City of Helena regarding its landfill leachate problem. Jim Leiter wrote to Dick Nisbet, Public Works Director, on May 17 and October 17, 1988 requiring specific monitoring actions. The enclosed chronology will show the monitoring results which led to Mr. Leiter's original concern.

To date, I have no knowledge of any response from the City of Helena to Mr. Leiter's requests. If you have such knowledge or responses, I would appreciate a copy. If not, I would ask that the matter be taken up with the City as soon as possible.

Please call me at 447-8354 if you have questions or wish to discuss this matter.

Sincerely,

A handwritten signature in blue ink that reads "Will I. Selser".

Will I. Selser, Director
Environmental Health Division

WIS/jm

Enclosures

cc: Dick Nisbet, City of Helena

(W) C:GROVER.WS

RECEIVED

JAN 03 1990

MONTANA DEPARTMENT OF HEALTH
AND ENVIRONMENTAL SCIENCES
SOLID & HAZARDOUS WASTE BUREAU

CHRONOLOGY

Groundwater Monitoring at City of Helena Landfill

Summary

Since 1980, monitoring wells located at the City of Helena's Landfill have recorded exceedences of the State Drinking Water Standards for the following constituents:

	Highest level	MCL ¹
Inorganics ²		
NO ₃ (Nitrate)	41.3ppm	10ppm
SO ₄ (Sulfate)	417ppm	250ppm (SMCL) (4)
Pb (Lead)	1300ppm	50ppb
Iron (Fe)	16800ppb	300ppb (SMCL)
Cadmium (Cd)	20ppb	10ppb
Total Dissolved Solids (TDS)	1293ppm	500ppm (SMCL)
Manganese	71.4ppm	50ppm (SMCL)
Volatile Organics (VOC) ³ :		
Tetrachloroethene	77ppb	0 PMCLG ¹
Trichloroethene	7ppb	5 ppb

other VOCs were detected at concentrations below the Drinking Water Standard or for which no standard has yet been promulgated

1,1 - dichloroethane

1,2 - dichloropropane

chloroform (2.4 x the background level)

Semi-volatile organics:

bis (2 - ethylhexyl) phthalate

butylbenzylphthalate

benzoic acid

It should be noted that there have been high reading of many of these constituents in the background well. This well is located next to both a sanitary sewer line and a storm drain (see map 1) which seriously compromises its usefulness.

¹ Region 9, EPA DRINKING WATER STDS and Health Advisory Table, September 21, 1987

² Groundwater monitoring parameters, MDHES Solid Waste Bureau database, Jim Leiter, 8/24/89

³ Analytical Results Report, Helena Landfill, FIT Zone II, TDD F08-8903-10-PAN FMT0051SEA, EPA ID MTD980071146

Chronology = Groundwater Monitoring at City of Helena Landfill
page 2

To give some perspective to the VOC levels, the highest reading at the Scratch Gravel landfill are compared to City of Helena levels:

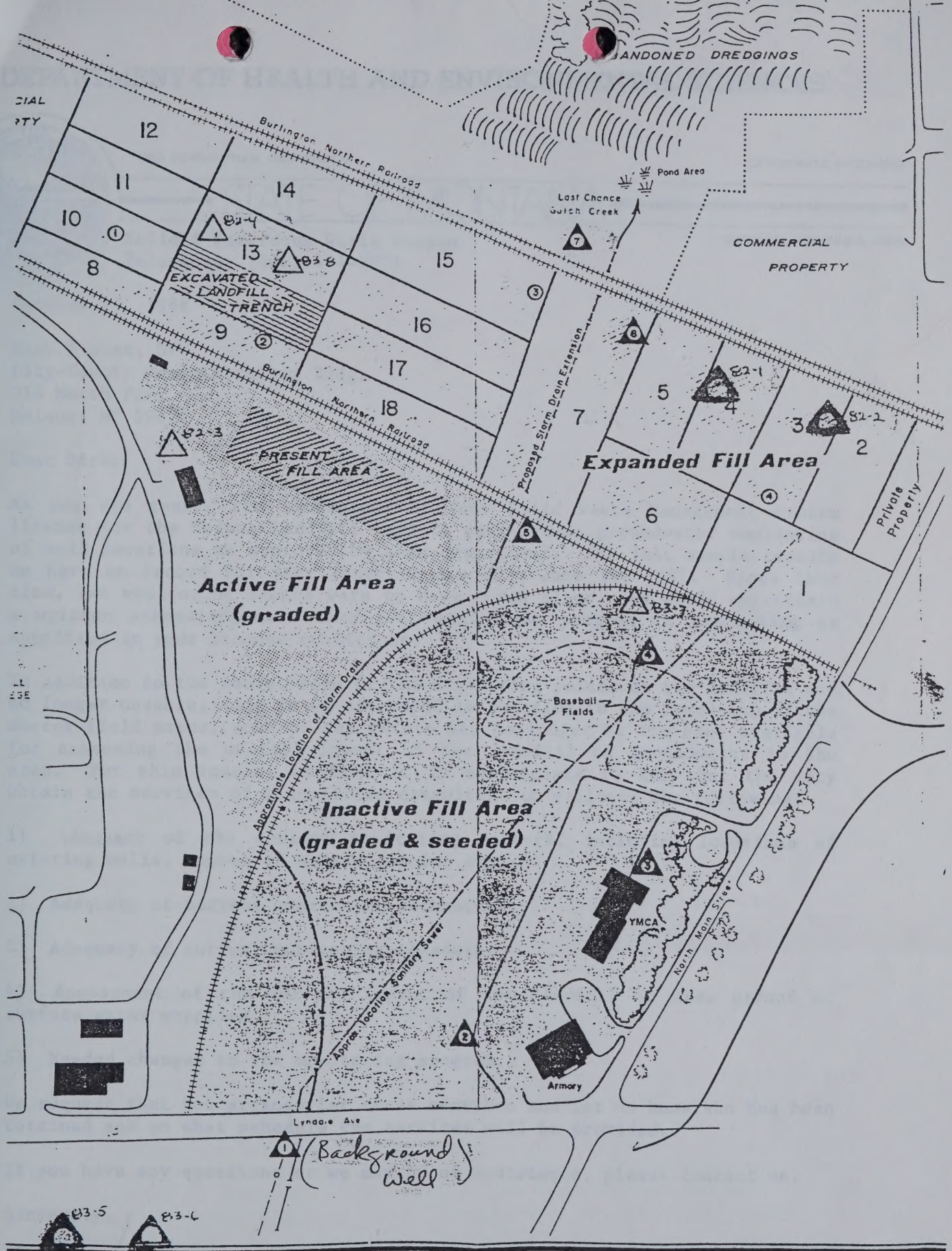
	<u>Scratch Gravel</u>	<u>Helena</u>
Tetrachloroethylene	3.0 ppb	77 ppb
Trichloroethene	4.0 ppb	7 ppb

Finally, the Montana DHES wrote on May 17, 1988, and required City Manager, Bill Verwolf, to retain a qualified hydrogeological consultant to examine the situation and make specific recommendations on future monitoring. Another letter was sent to City Public Works Director, Dick Nisbet, on October 17, 1988 requesting the same action. to date, no response has been received (personal communication, Jim Leiter, MDHES, August 29, 1989).

MCL = Maximum contaminant Level (EPA Drinking Water Std.)
SMCL = Secondary Maximum Contaminant Level
PMCLG = Proposed Maximum Contaminant Level = EPA has officially proposed,
but not officially adopted these levels.
ppm = parts per million (1×10^{-6})
ppb = parts per billion (1×10^{-9})

WS/jm
8/31/89

H2o_M C:CHLF.GM



DEPARTMENT OF HEALTH AND ENVIRONMENTAL SCIENCES



TED SCHWINDEN, GOVERNOR

COGSWELL BUILDING

STATE OF MONTANA

Solid & Hazardous Waste Bureau
Telephone: (406) 444-2821

HELENA, MONTANA 59620

October 17, 1988

Dick Nisbet, DPW
City-County Administration Bldg.
316 North Park
Helena, MT 59623

Dear Dick:

As you are aware, the conditions of your Solid Waste Management System license for the Helena Landfill include semi-annual groundwater monitoring of well locations as approved by this department. The last sample results we have on record for your landfill are from June 15, 1987. Since that time, two monitoring events were to have taken place. We would appreciate a written acknowledgement that your monitoring program is proceeding as specified in your license conditions.

In addition to the above, some of the monitoring points at the landfill are no longer useable, and, as we discussed in relation to the reseeding of the soccer field areas, some of the points may no longer be the best available for assessing the overall impact of the landfill on groundwater in the area. For this reason, we feel it is appropriate to ask that the city obtain the services of a qualified consultant to evaluate the following:

- 1) Adequacy of the current monitoring network, including locations of existing wells, number of sample points, etc.
- 2) Adequacy of current monitoring parameters.
- 3) Adequacy of current monitoring schedule.
- 4) Assessment of the current impact of the landfill on area ground or surface water supplies.
- 5) Needed changes to the monitoring program.

We request that you arrange for these services and let us know who has been retained and on what schedule the services will be provided.

If you have any questions or we may be of assistance, please contact us.

Sincerely,

James E. Leiter, R.S.

cc: Will Selser, City-County Health Department
Ted Hill, City of Helena

Bob- should we get involved in this?
Will only To make sure waste follows solid through
DEPARTMENT OF HEALTH AND ENVIRONMENTAL SCIENCES *BJ*



TED SCHWINDEN, GOVERNOR

COGSWELL BUILDING

STATE OF MONTANA

Solid & Hazardous Waste Bureau
Telephone: (406) 444-2821

HELENA, MONTANA 59620

May 17, 1988

June - file under City of Helena Landfill

Bill Verwolf, City Manager
City of Helena
City-County Administration Building
Helena, Montana 59601

Dear Mr. Verwolf:

Duane Robertson and I recently visited with Randy Lilgee regarding the installation of the irrigation system over the old landfill area behind the Y.M.C.A. Although we generally approve of programs to develop old landfill sites for useful purposes, we have some concerns about development and operation of this particular irrigation system. We have discussed these concerns with Randy, but thought that it would be best to go on record officially and directly to city management, as owner and operator of the landfill and the proposed recreation area.

In 1982, this department gave conceptual approval to development of the soccer fields/ball parks at the site. This approval included the expression of reservations about the potential for environmental damage should the system in any way add additional moisture to buried waste in any section of the city landfill. The letter of conceptual approval (copy enclosed) was conditional on strict adherence to a report entitled "Hydrogeological Evaluation, Helena Municipal Landfill, Helena, Montana, dated June 30, 1982, and prepared by Hydrometrics, 2727 Airport Road, Helena, Montana. I have also enclosed a photocopy of the section of the document relating to conditions which should be placed upon any irrigation system.

From our visit with Randy and from our short review of the plans Randy has on file, it was apparent that at least some of the controls we had expected in the system have not been provided. Randy has provided us a set of plans and specifications for the project, and we should be able to better address specific comments upon a thorough review, but some of the comments we have so far, based on conditions specified in the Hydrometrics document, are as follows. I have numbered the conditions in accordance with the Hydrometrics report:

2) A soil survey of the cover material should be provided to determine consistency, soil types, distribution, depth, texture and water holding capacity. It doesn't appear that this has been completed.

4) An irrigation schedule and application log book should be maintained to show all water applied. Randy indicated that this has yet to be developed. An automatic shut-off has been proposed for the system, but there is only one tensiometer proposed. We doubt that one sensor/shut-off is adequate for positive assurance and would suggest consideration for more automatic shut-offs in the system. We would also believe that a back-up system should be provided to insure performance. A greater number of automatic shut-offs could provide this needed back-up function.

5) All pipe should be of specified quality and leak tested upon installation. We assume this has been planned, but do not know for sure.

6) When not in use, the main sprinkler pipelines should not be pressurized. According to Randy, the system will be shut off and drained in the winter. Since the 4" pressurized main line will be located across the fill, and it will be continuously under pressure in the summer, some provisions should be in place for routine leak testing. In the event the line or any valves or lateral lines were to leak, the impact upon the landfill would be significant.

7) The water system should be inspected monthly during the summer season. We believe that a written Standard Operating Procedure (S.O.P.) should be in place, describing exact testing and recording.

8) Soil moisture should be measured at 15 to 30 key locations over the fill area to measure actual penetration. Apparently the city has no portable tensiometer or other device adequate for this and has not as yet planned such periodic measurement. We believe this is essential.

9) A comprehensive groundwater system and gas monitoring system should be installed and operated within and peripheral to the watered area. Specific monitoring recommendations are given in the Hydrometrics report.

The existing monitoring system needs restoration in order to accurately monitor the landfill site. Several of the monitoring wells have become obstructed or have been destroyed by landfilling. Gas monitoring, to our knowledge, does not currently take all the recommendations of the report into account. There are other needed improvements to the monitoring system.

As I have stated, there may be other comments once we have the opportunity to review the plans. These comments are immediately evident from a partial review, however.

Since the Hydrometrics report was prepared in 1982, we have had the opportunity to examine a broader background of water samples than before the report. We know several things about the site from the sampling. Particularly, we know that some inorganic and organic contaminants are leaching from the landfill site. The available evidence suggests that the city needs to use every available precaution in normal operating procedures for this landfill site, particularly as regards any additions of moisture, whether natural or man-made, to the site.

Therefore, we will require the following:

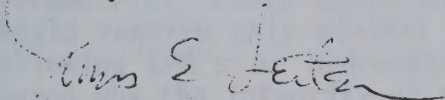
1) A qualified hydrogeological consultant must be retained to carefully examine the issues addressed in the Hydrometrics report including the irrigation system design, operation, maintenance, record keeping, and monitoring. The consultant should also address the gas and groundwater monitoring results to date and should make recommendations for continued monitoring in light of the installation of the irrigation system. Certainly most important, the consultant should evaluate the current proposal and determine what equipment and/or procedures are required to insure that there is no chance of adding additional moisture into the buried refuse at the site.

2) Either the consultant, or another qualified authority, must perform a "water balance" calculation for the landfill, in order to determine the maximum amount of moisture which can be added to the site under all conditions while preventing downward migration of moisture. This figure must be used as the limiting factor in irrigation of the vegetative cover.

3) No irrigation of the old landfill area may begin until this office has had an opportunity to thoroughly review and approve your proposal.

We would be happy to meet with your city staff or your hydrogeological consultant to discuss the improvements and changes we feel are appropriate. If you have any questions or we may be of service, please contact this office.

Sincerely,



James E. Leiter, R.S.

cc: Dick Nisbet, DPW
Randy Lilgee, Parks Dept.
Will Selser, City-County Health Dept.

RECEIVED

Hydrometrics, Inc.

2727 Airport Road • Helena, Montana 59601 • (406) 443-4150

*Sanitation
Landfill Study
Hydrometrics*

April 4, 1990

RECEIVED

APR 5 1990

PUBLIC WORKS

Dick Nisbet
Director of Public Works
City of Helena
City/County Building
316 N. Park
Helena, Montana 59623

RE: Helena Landfill

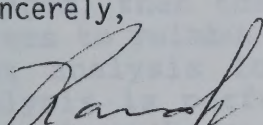
Dear Dick,

Enclosed is a copy of the EPA Access Agreement for sampling monitoring wells in the vicinity of the Helena Landfill. The document requires that your consultant sample wells in accordance with EPA Superfund criteria.

Hydrometrics' Field Operating Procedures are similar to the EPA's, so it should require only minimal additional effort to follow EPA protocol. By following EPA's or Hydrometrics' Field Operating Procedures, there is no reason why the integrity of the well should be compromised.

At your convenience, please review the document and feel free to give me a call with any questions or comments. MDHES will require a signature before we can sample the wells.

Sincerely,


Randy L. Huffsmith
Project Manager

RLH:ls

Enclosure

c: Max Botz, President, Hydrometrics

RECEIVED

APR 5 1991

MONTANA DEPARTMENT OF HEALTH
AND ENVIRONMENTAL SCIENCES
SOLID & HAZARDOUS WASTE BUREAU

PERMISSION FOR ACCESS TO EPA/MDHES MONITORING WELLS

I, the undersigned, am the owner, or his/her authorized representative, or I otherwise control the real property at the location described below.

My signature on this document signifies that I agree to protect and maintain the monitoring wells installed on my property at the Helena City Lanfill site by the Environmental Protection Agency (EPA) and the Department of Health and Environmental Sciences (DHES), as shown is figure 1. I also agree to allow site access to DHES to undertake those investigations, monitoring, testing, removal or other activities that DHES determines are required to adequately protect public health, welfare, safety or the environment.

To protect and maintain the monitoring wells means that I agree to protect the integrity of the monitoring wells, to ensure that locking caps are in place and adequate to protect the wells, to ensure that properly decontaminated bailers are used in each well to prevent contamination, and generally to prevent any alteration or damage to the wells. I agree to conduct all sampling in accordance with EPA Superfund Field Operations Procedures (EPA/540/P-87/001) and to provide documentation of my compliance with these procedures.

In addition, my signature on this document signifies that I agree to allow EPA and DHES access to site monitoring wells at any reasonable time without prior notice. If at any time EPA or DHES desires to sample these wells, and, upon sampling obtains evidence that the wells were intentionally or negligently altered or damaged, then the City of Helena or its authorized representative agrees to reimburse DHES for the cost of a full hazardous substance list analysis for each affected monitoring well. If such an analysis is performed and evidence is obtained that the well or wells have been negligently or intentionally altered and if the wells cannot be returned to their condition existing upon the date this form is signed, then the City of Helena or its authorized representative shall provide, at no cost to DHES, replacement wells at the request and direction of DHES.

COMPANY ADDRESS

City of Helena
316 N. Park Ave.
Helena, MT 59623

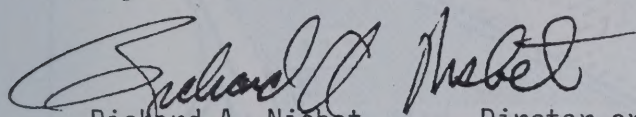
WELL LOCATION

Shown on the attached figure 1
NE1/4 NE1/4 N1/4 Sec. 30 T10N R3W
Lewis and Clark County, MT



page 2. PERMISSION FOR ACCESS TO EPA/DHES MONITORING WELLS

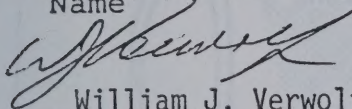
Signature of Owner/Manager/Representative



Richard A. Nisbet
Name

Director or Public Works
Title

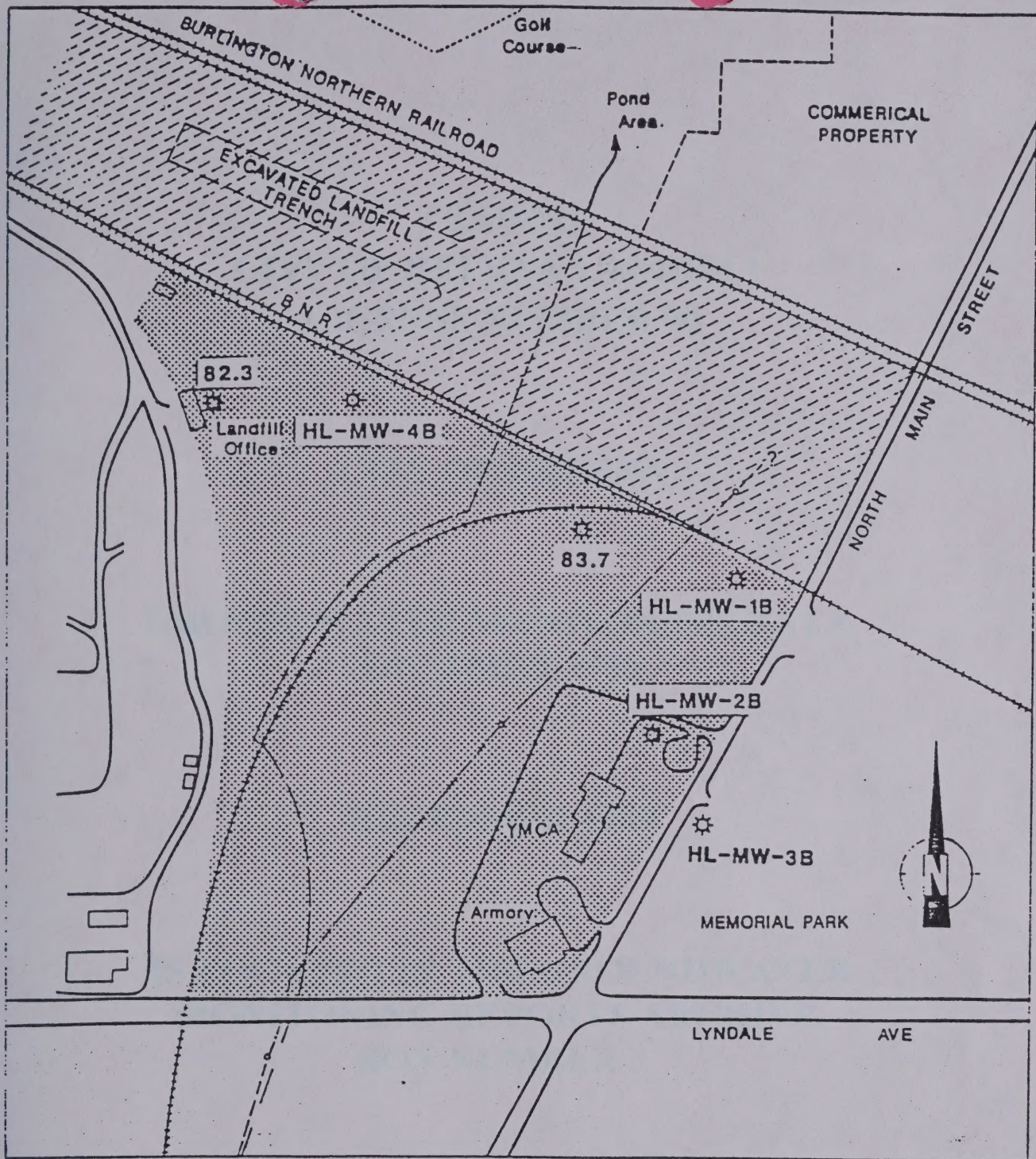
Date: 4-12-90



William J. Verwolf
Name

City Manager
Title

Date: 4-12-90



600' 0 300' 600'

LEGEND

- Approximate location of storm drain (Last Chance Gulch Creek)
- Approximate location of sanitary sewer
- Inactive Fill Area (Graded and Seeded)
- ▤ Active Fill Area

FIELD INVESTIGATIONS OF UNCONTROLLED HAZARDOUS WASTE SITES TASK REPORT TO THE E.P.A.

TITLE:

HELENA LANDFILL
Helena, Montana
SAMPLE LOCATION MAP

T.D.D. F08-8903-10

ecology & environment, inc.
DENVER, COLORADO

FIG. 1

Date: 05/89 Drawn by: RSM Scale: 1" = 600'

CLOSED
CITY OF HELENA LANDFILL
LICENSE NUMBER 90

CITY OF HELENA

GROUNDWATER MONITORING DATA,
OCTOBER 1989

DECEMBER 1989

IS LOCATED IN THE GROUNDWATER
MONITORING REPORTS ARCHIVE,
BOX NUMBER 3

RECEIVED 1/5/1990

CLOSED
CITY OF HELENA LANDFILL
LICENSE NUMBER 90

CITY OF HELENA

GROUNDWATER MONITORING DATA,
SEPTEMBER 1980 - OCTOBER 1989

OCTOBER 1989

IS LOCATED IN THE GROUNDWATER
MONITORING REPORTS ARCHIVE,
BOX NUMBER 3

RECEIVED ?



City-County Building
P.O. Box 1723
Helena, Montana 59624
Telephone 406/443-1010

LEWIS AND CLARK COUNTY

Health Department

August 18, 1989

RECEIVED

AUG 21 1989

MONTANA DEPARTMENT OF HEALTH
AND ENVIRONMENTAL SCIENCES
SOLID & HAZARDOUS WASTE BUREAU

Jim Leiter
Solid & Hazardous Waste Bureau
SDHES
Cogswell Building
Helena, MT 59620

Dear Jim:

Could you please give me an update on the recent groundwater incident at the City of Helena landfill? What additional monitoring will you require as a result?

The city staff has indicated that the Helena landfill has historically been the site of numerous solvent disposals. Are they currently monitoring for TOX or specific VOCs?

Finally, we have not received any copies of monitoring data on the City landfill since late 1987. Did they ever respond to your request for the required semi-annual monitoring? We would like copies of any data or correspondence you have received to date on this matter.

Thank you.

Sincerely,

Will Selser

Will Selser, Director
Environmental Health Division

WS/jm

SWM C:LEITER.WS

CLOSED
CITY OF HELENA LANDFILL
LICENSE NUMBER 90

CITY OF HELENA

GROUNDWATER MONITORING DATA, MAY
1989

JUNE 1989

IS LOCATED IN THE GROUNDWATER
MONITORING REPORTS ARCHIVE,
BOX NUMBER 3

RECEIVED 7/5/1989

**CLOSED
CITY OF HELENA LANDFILL
LICENSE NUMBER 90**

CITY OF HELENA

**JUNE 1987 GROUNDWATER MONITORING
RESULTS**

AUGUST 1988

**IS LOCATED IN THE GROUNDWATER
MONITORING REPORTS ARCHIVE,
BOX NUMBER 3**

RECEIVED 8/16/1988

MEMORANDUM

TO: City of Helena Monitoring File

FROM: Jim Leiter

DATE: May 13, 1988

SUBJ: Review of monitoring records

This date I completed a review of monitoring records for this landfill. The records are dated from 12/82 through the F.I.T. investigation of 9/87. I have summarized my findings for purpose of reference in the future.

There have been 15 GW monitoring well installed by the city at the site. In addition, the F.I.T. installed two additional wells, which are currently capped. Three of the wells are "upstream" of Last Chance Gulch. There is one well up near the YMCA and there are 4 wells in the oldest section of the landfill. The additional two F.I.T. wells are located in this area.

There are three wells located east of the drainage pipe in the expansion area. Two wells are located west of this pipe in the area currently being trenched, and there is one well located at the base of the Carroll College hill, west of the utility building.

Several of the wells are blocked or have been placed out of service by landfill or other construction activities. These include: #2, #6, #82-1, and #83-8. In addition, well #5 may be temporarily lost due to lack of a marking.

The monitoring records appear to show that the landfill is underlain by fair to poor quality water. Most monitoring information is obscured by the fact that the background wells in Last Chance Gulch are of poor quality from the drainage of the gulch, including metals from run-off, etc. There have been periodic exceedences in nitrates, cadmium and zinc noted in these wells.

Despite the poor background available for comparison, several trends seem apparent. Water quality appears to be degraded beneath the landfill to a varying degree, with seasonal and spatial differences. The oldest area of the site (soccer field area) is the most degraded. This is followed by poorest water quality in wells #6 and #7, in the center of the Last Chance Gulch drainage through the site. Parameters showing elevations over apparent background include hardness, chlorides, nitrates, lead, iron and manganese. The three metals seem particularly elevated, far exceeding drinking water requirements. The affect seems variable, however, over time. Other parameters show some impact, but to a less significant degree.

The wells on the east side of the site, the last area landfilled, show periodic high levels of nitrate. It would appear that the sewer line through the landfill may leak periodically, elevating the nitrate levels to as high as 35 p.p.m. Well 82-1 is blocked, however, so it is difficult to tell whether or not the nitrate contamination spreads to the center portion

of the site from the sewer pipe or from the soccer field area of the site. One sample of well #6 showed nitrates above DWS, but #7 has never been affected to the point of exceeding DWS. Background well #1 has also shown a high nitrate spike in the past, but is similarly located very near the sewer line. Other wells near the line are #4 and #82-2, which both show high nitrates.

Wells on the west side appear unaffected by landfilling to date. The most recent trench has been dug north of the monitoring wells, however, and is essentially unmonitored. This should be changed. The "background" well for this area is the only well drilled into limestone bedrock, and it appears to have slightly different water quality than the other wells. In general, groundwater is at a deeper level in the west portion of the site and landfilling has remained further above the aquifer below this area than in the east.

The draft F.I.T. investigation notes several organic parameters likely in groundwater below the soccer field area. These include tetrachloroethene, benzene, toluene, m- & p- xylene, and o-xylene. Only TCE has been documented in groundwater. Some presence of chloroform is noted in surface water below the landfill and not above it, but levels are very low. No conclusions have been drawn from the F.I.T. yet. Manganese is documented as extremely high in several wells on site. The report says that high levels are not uncommon in the Helena Valley aquifer, but the levels jump dramatically across the landfill area.

HELENA MONITORING SUMMARY

Background Quality (Wells #1, #83-5 and #83-6)

Hardness	330 - 950
Conductivity	800 - 1000
Chlorides	20 - 55
Total Alkalinity	200 - 320
NO3	0 - 35
Na	10 - 70 (highest in #1)
Cd	Exceedences in: #1(2X), #83-5(1X)
Zn	.03 - 1.2 (highest in #1)
Cu	0 - .37 (highest in #1)
Ni	0 - .14 (highest in #1)
Pb	.01 - .33 (higher all along)
Fe	0 - .11 (highest in #1/few occurrences)

Oldest Area of Landfilling (Wells #4, #5 and #83-7)

Hardness	580 - 1200
Conductivity	1220 - 2300 (highest in #83-7)
Chlorides	68 - 190 (highest in #83-7)
Total Alkalinity	280 - 560 (consistent)
NO3	.25 - 19 (highest in #4, low in other two)
Na	20 - 100 (consistent)
Cd	Exceedences in #5(2X), #83-7(2X)
Zn	.07 - 3.3. (highest in #5)
Cu	.004 - .34 (highest in #83-7)
Ni	.009 - .20 (highest in #83-7)
Pb	.01 - 1.3 Exceedences in #5(2X), #83-7(4X)
Fe	.06 - 7.66 Almost all exceeded

East of Last Chance Drainage (Wells #82-1 and #82-2)

Hardness	370 - 570 (highest in #82-2)
Conductivity	822 - 1200 (increases with time)
Chlorides	34 - 42
Total Alkalinity	180 - 200
NO3	6 - 35 (almost all exceedences)
Na	10 - 25
Cd	.01 One exceedance in 82.2
Zn	.01 - .56 (highest in #82-2)
Cu	.01 - .04
Ni	.006 - .03
Pb	.01 (all)
Fe	N.D. - .88 (highest in #82-1)

Drainage Center (wells #6 and #7)

Hardness	410 - 660
Conductivity	600 - 1300 (highest in #6, increases slowly in #7, 600 - 900)
Chlorides	22 - 60
Total Alkalinity	180 - 580 (range of values all w/in #7)
NO3	1 - 12 (one Exceedence in #6)
Na	10 40
Cd	Generally low, One Exceedence in #6, .01)
Zn	.0069 - .35 (slightly higher in #7)
Cu	.001 - .39 (highest in #6)
Ni	.01 - .08
Pb	.01 - .28 Exceedences: #6(1X), #7(3X)
Fe	.04 - 16.8 Exceedences: #6(1X), #7(1X)

West Expansion Area Background (Well #82-3)

Hardness	370 - 1190
Conductivity	1160 - 1300
Chlorides	25 - 40
Total Alkalinity	370 - 500
NO3	1.9 - 9.8 (highest early in sampling)
Na	20 - 40
Cd	Insig.
Zn	.01 - .05
Cu	.01 - .06
Ni	N.D. - .01
Pb	Less than .01
Fe	N.D. - Less than .03

West Expansion Area North of First Trench (Wells #82-4 and #83-8)

Hardness	260 - 620 (highest in #83-8)
Conductivity	750 - 1150 (highest in #83-8)
Chlorides	31 - 42
Total Alkalinity	220 - 390 (highest in #83-8)
NO3	1.2 8.8 (highest in #82-4)
Na	7 64 (range entirely w/in #83-8)
Cd	N.D. - .005
Zn	Less than .01 - .14
Cu	N.D. - .18 (highest in #83-8)
Ni	.005 - .03
Pb	Less than .01 - .05
Fe	N.D. - .19 (most samples N.D.)

TRENDS ACROSS SITE FROM BACKGROUND DOWNSTREAM

* Hardness	Rising, but highest in old area and then new area. Well nearest Carroll high.
Conductivity	Highest in old area and background. Rising.
* Chlorides	Highest in old area, 3X others.
Total Alkalinity	Insig. Low, approx at D.W.S. in old area.
* NO3	#82-1 and #82-2 bad, but background suspicious. Appears high near sewer line through site.
Na	Insig.
Cd	Insig. (poor background)
Zn	Insig. (slightly worse in old area, background one of highest.)
Cu	Insig.
Ni	Insig.
* Pb	Probably evidence of plume. Well above D.W.S. Background high at times.
* Fe	Well above D.W.S. Highest in old area and in center of drainage. None in Background.
* Mn	High in F.I.T. report. Background 350 micrograms, #83-7 11,400 micrograms. Report says manganese oxides naturally high in valley.

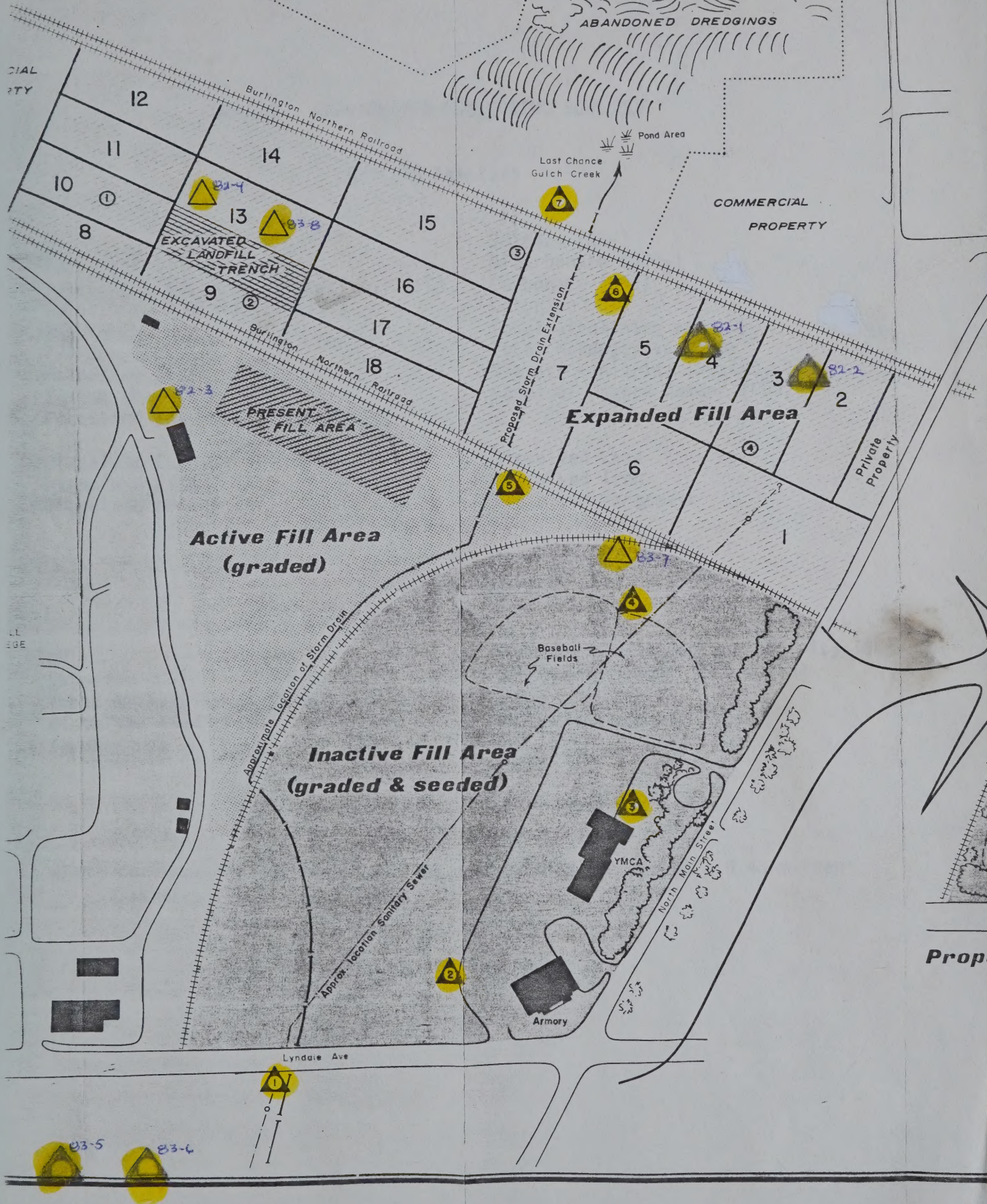


TABLE 2. GROUNDWATER MONITORING SCHEDULE

COMPLETE ANALYSIS

pH	Sulfate (SO_4)
Temperature	Bicarbonate (HCO_3)
Specific Electrical Conductivity (SC)	Carbonate (CO_3)
Total Dissolved Solids (TDS)	Chloride (Cl)
Turbidity	Total Alkalinity as CaCO_3
Calcium (Ca)	Total Hardness as CaCO_3
Magnesium (Mg)	Nitrate + Nitrite ($\text{NO}_3 + \text{NO}_2 - \text{N}$)
Sodium (Na)	Chemical Oxygen Demand (COD)
Potassium (K)	
Dissolved Cadmium	Dissolved Lead
Dissolved Zinc	Dissolved Iron
Dissolved Copper	Dissolved Manganese

PARTIAL ANALYSIS

pH	Specific Electrical Conductivity (SC)
Chloride (Cl)	Nitrite + Nitrate ($\text{NO}_2 + \text{NO}_3 - \text{N}$)
Total Alkalinity as CaCO_3	Sodium (Na)
Dissolved Iron (Fe)	Total Hardness as CaCO_3
Temperature	Turbidity

NOTE: All samples for metal will be field filtered through a 0.45 micron filter.

**CLOSED
CITY OF HELENA LANDFILL
LICENSE NUMBER 90**

JIM LEITER

**REVIEW OF MONITORING RECORDS,
SEPTEMBER 1980 - JUNE 1987**

MAY 1988

**IS LOCATED IN THE GROUNDWATER
MONITORING REPORTS ARCHIVE,
BOX NUMBER 3**

RECEIVED 5/13/1988

**CLOSED
CITY OF HELENA LANDFILL
LICENSE NUMBER 90**

CITY OF HELENA

**JUNE 1987 GROUNDWATER MONITORING
RESULTS**

SEPTEMBER 1987

**IS LOCATED IN THE GROUNDWATER
MONITORING REPORTS ARCHIVE,
BOX NUMBER 3**

RECEIVED 9/24/1987

**CLOSED
CITY OF HELENA LANDFILL
LICENSE NUMBER 90**

CITY OF HELENA

**GROUNDWATER MONITORING DATA,
SEPTEMBER 1980 - SEPTEMBER 1986**

SEPTEMBER 1986

**IS LOCATED IN THE GROUNDWATER
MONITORING REPORTS ARCHIVE,
BOX NUMBER 3**

RECEIVED 1/2/1987

**CLOSED
CITY OF HELENA LANDFILL
LICENSE NUMBER 90**

CITY OF HELENA

**GROUNDWATER MONITORING DATA,
DECEMBER 1984 - APRIL 1986**

JULY 1986

**IS LOCATED IN THE GROUNDWATER
MONITORING REPORTS ARCHIVE,
BOX NUMBER 3**

RECEIVED 7/23/1986

**CLOSED
CITY OF HELENA LANDFILL
LICENSE NUMBER 90**

CITY OF HELENA

**GROUNDWATER LEVEL DATA, JANUARY
1982 - NOVEMBER 1984**

NOVEMBER 1984

**IS LOCATED IN THE GROUNDWATER
MONITORING REPORTS ARCHIVE,
BOX NUMBER 3**

RECEIVED 11/28/1984

**CLOSED
CITY OF HELENA LANDFILL
LICENSE NUMBER 90**

CITY OF HELENA

**GROUNDWATER ANALYTICAL DATA,
OCTOBER 1984**

OCTOBER 1984

**IS LOCATED IN THE GROUNDWATER
MONITORING REPORTS ARCHIVE,
BOX NUMBER 3**

RECEIVED 11/2/1984

**CLOSED
CITY OF HELENA LANDFILL
LICENSE NUMBER 90**

CITY OF HELENA

**GROUNDWATER LEVEL DATA, JANUARY
1982 - AUGUST 1984**

AUGUST 1984

**IS LOCATED IN THE GROUNDWATER
MONITORING REPORTS ARCHIVE,
BOX NUMBER 3**

RECEIVED 8/23/1984

**CLOSED
CITY OF HELENA LANDFILL
LICENSE NUMBER 90**

CITY OF HELENA

**GROUNDWATER MONITORING DATA, JULY
1984**

JULY 1984

**IS LOCATED IN THE GROUNDWATER
MONITORING REPORTS ARCHIVE,
BOX NUMBER 3**

RECEIVED 7/19/1984

**CLOSED
CITY OF HELENA LANDFILL
LICENSE NUMBER 90**

CITY OF HELENA

**GROUNDWATER LEVEL DATA, JANUARY
1982 - MAY 1984**

MAY 1984

**IS LOCATED IN THE GROUNDWATER
MONITORING REPORTS ARCHIVE,
BOX NUMBER 3**

RECEIVED 5/17/1984

**CLOSED
CITY OF HELENA LANDFILL
LICENSE NUMBER 90**

CITY OF HELENA

**GROUNDWATER MONITORING DATA,
MARCH 1984**

APRIL 1984

**IS LOCATED IN THE GROUNDWATER
MONITORING REPORTS ARCHIVE,
BOX NUMBER 3**

RECEIVED ?

**CLOSED
CITY OF HELENA LANDFILL
LICENSE NUMBER 90**

CITY OF HELENA

**GROUNDWATER LEVEL DATA, SEPTEMBER
1980 - MARCH 1984**

MARCH 1984

**IS LOCATED IN THE GROUNDWATER
MONITORING REPORTS ARCHIVE,
BOX NUMBER 3**

RECEIVED ?

CLOSED
CITY OF HELENA LANDFILL
LICENSE NUMBER 90

WATER QUALITY BUREAU

GROUNDWATER ANALYTICAL DATA,
OCTOBER 1983

NOVEMBER 1983

IS LOCATED IN THE GROUNDWATER
MONITORING REPORTS ARCHIVE,
BOX NUMBER 3

RECEIVED ?

Helena, Mt.

State: Montana County: Lewis & Clark Project: City of Helena Hole Name or Number: 83-5

Legal Location: T 10N R. 3W Sec. 30 Tract. BD Descriptive Location: SW corner of State Landfill Surplus parking

Recorded by: DRS Date Hole Started: 10/7/83 Date Hole Completed: 10/10/83 Driller: Tim Drilling Company: Lindsay

Drill Method: Top Drive Rotary Drilling Fluids Used: Water Pilot Hole Diameter: 7-7/8" Reamed Hole Diameter: _____

Total Depth Drilled: 23' Total Depth Reamed: - Total Depth Cased Below G.S.: 19' Diameter and Type of Casing: 7" OD Steel

Weight or Gage of Casing: 0.25 Wall steel Interval Perforated or Screened Below G.S.: 12 - 17' Target Aquifer: Alluvium Packer Type and Depth Below G.S.: -

	YES	NO
Well Developed?	_____	X
Well Test Pumped?	_____	X
Water Samples Taken?	_____	X
Material Samples Taken?	_____	X
E - Logs?	_____	X

Method Perforated or Screened:

_____ No casing in hole.

_____ Open bottom only.

_____ Slotted with Mill's Knife.

_____ Slotted with a torch.

_____ Screened by pulling casing.

_____ Saw cut

 X Other (specify) Wheel Perforator

Static
Water Level: _____ Date: _____

Measuring Point _____ MP Height Above (+)
Description/Elevation: _____ or Below G.S.: _____

Well Annulus
Completion Description: Perforated 6" casing with air "wheel" perforator, drive shoe on casing-1

Remarks: Inject water at 10 ft.; blew @ 19 ft.; drove steel casing to 18½'

[illegible]

Helena, Mt.

State: Montana County: Lewis & Clark Project: Helena Landfill Hole Name or Number: 83-6

Legal
Location: T. 10N R. 3W Sec. 30 Tract. BD Descriptive SE corner of State Surplus parking lot

Recorded by: DCP Date Hole Started: 10-10-83 Date Hole Completed: 10-10-83 Driller: Tim Drilling Company: Lindsay

Drill Method: Rotary Drilling Fluids Used: Water Pilot Hole Diameter: 7-7/8" to 20' Reamed Hole Diameter: 5-7/8" to 25' -

Total Depth Drilled: 25 Total Depth Reamed: - Total Depth Cased Below G.S.: 23 Diameter and Type of Casing: 7" OD Surface casing to 19' - 4" PVC to 23'

Weight or 0.25 wall Interval Perforated Target Alluvium &
Gage of Casing: Steel or Screened Below G.S.: 19-23 Aquifer Top of Bed- Packer Type and
Depth Below G.S.: None

160 PSI PVC	YES	NO
-------------	-----	----

Well Developed? X

Well Test Pumped? X

Water Samples Taken? X

Material Samples Taken? _____ X _____

E - Logs? X

Static
Water Level: _____ Date: _____

Measuring Point Description/Elevation: _____ MP Height Above (+) or Below G.S.: _____

Well Annulus
Completion Description: Bentonite seal at surface, 4" PVC in 6" steel surface casing

Remarks: Caved bottom 2 feet when installing plastic; blew 1-2 gpm with rig

[illegible]

Helena, Mt.

Legal
Location: T 10N R 3W Sec. 30 Tract. BA Descriptive Location: Approx. 20' s. of railroad spur; n. of baseball diamonds

Recorded by: DRS Date Hole Started: 10/7/83 Date Hole Completed: 10/7/83 Driller: Tim Drilling Company: Lindsay
 Drill Top Drive Air;
 Method: Rotary Drilling Fluids Used: Water @ 20' Pilot Hole 7-7/8" to 19' Reamed Hole
 Diameter: then 5-7/8" Diameter: -
 Total Depth 40' Total Depth - Total Depth 6" OD steel to 19' Diameter and 7" OD Steel to 19'
 Drilled: 40' Reamed: - Cased Below G.S.: 4" PVC to 37' Type of Casing: 4" PVC to 37'

Weight of 7"-.25 wall steel
Gage of Casing: to 19' or Screened Below G.S.: 32 - 37' Target Alluvium Packer Type and Depth Below G.S.: N/A
160 PSI PVC to 37' YES NO Method Perforated or Screened:

Well Developed?	_____	X	_____	No casing in hole.
Well Test Pumped?	_____	X	_____	Open bottom only.
Water Samples Taken?	_____	X	_____	Slotted with Mill's Knife.
Material Samples Taken?	_____	X	_____	Slotted with a torch.
E - Logs?	_____	X	_____	Screened by pulling casing.

Static Water Level: 34.6' Date: 10/7/83

Measuring Point
Description/Elevation: Top of PVC casing - north side

Well Annulus
Completion Description: Cased with 6" steel to 19'

Remarks: Injected water at about 20'; blew with rig @ 40'; made little water

[illegible]

Helena, Mt.

State: Montana County: Lewis & Clark Project: City of Helena Hole Name or Number: 83-8

Legal
Location: T. 10N R. 3W Sec. 19 Tract. CD Descriptive
Location: NE corner of active Landfill cell

Recorded by: DRS Date Hole Started: 10/7/83 Date Hole Completed: 10/7/83 Driller: Tim Drilling Company: Lindsay

Drill Top Drive Drilling 7-7/8" to 19' Reamed Hole
Method: Rotary Fluids Used: Water Diameter: 5-7/8" to 60' Diameter: -

Total Depth Drilled: 60' Total Depth Reamed: - Total Depth Cased Below G.S.: 58' Diameter and Type of Casing: 7" OD Steel to 17' 4" PVC

0.25" wall steel
Weight or Interval Perforated
Gage of Casing: 160 PSI or Screened Below G.S.: 50 - 60' Target: Alluvium Packer Type and Depth Below G.S.: None
PVC YES NO Method Perforated or Screened:

Well Developed?	_____	_____	_____	No casing in hole.
Well Test Pumped?	_____	_____	_____	Open bottom only.
Water Samples Taken?	_____	_____	_____	Slotted with Mill's Knife.
Material Samples Taken?	_____	_____	_____	Slotted with a torch.
E - Logs?	_____	_____	_____	Screened by pulling casing.
Static				<u> X </u> Saw cut
Water Level: 41.62'		Date: 10/7/83		Other (specify)

Measuring Point _____ MP Height Above ($\pm$)
Description/Elevation: _____ or Below G.S.: _____

Well Annulus Completion Description: Bentonite @ surface

Remarks: Difficult drilling first 20 feet; became easier in sandy-clay seams

[illegible]

WELL DEVELOPMENT LOG

Well No. 83-5WELL DATAPROJECT: Name City of Helena landfill State MT County L & CLocation: T R Sec. Tract Well Location (Narrative Desc.) SW corner of of state surplus parking lotWell Depth (Ft.) 19 Diameter (In.) 4.0 Perf. Interval 12-17Static Water Level 11:90 Below MP MP Desc. TOP of steel casing Date 10/26/83
SW = 0.6 Meas. Time 11:55Aquifer Alluvium - thin gravel zoneDEVELOPMENT DATADate 10/26/83 Time Started 1205 Time Finished Total Development Time Est. Yield at Start Est. Yield at End Equipment: Bailer Sand Pump Compressor Surge Block Drilling (Other-Specify)Desc. of Equipment Hydra 3" steel 1.7gal bailerDev. Additives Used Desc. of Packer & Surface Seals Water Color & Turbidity: At Start At End Static Water Level After Development: Time After Dev. Ended 12:5 SWL 21.00 Trend Very Slow RecoveryOperator DRS WLC Water Quality Samples Taken: 1235 20.60 1340 17.79 Yes NoREMARKS: Bailed 15 gals. Waited for Recovery. Sampled at 1350 hrs7(36) / 25 = 10 gals of water in 1 volume

WELL DEVELOPMENT LOG

Well No. 83-6

WELL DATA

PROJECT: Name City of Helena Landfill State MT County L&CLocation: T R Sec. Tract Well Location (Narrative Desc.) SE corner of State Surplus parking lot in
taxingWell Depth (Ft.) 23 Diameter (In.) 4.0 Perf. Interval Static Water Level 13.23 Above
Below MP SV = 0.7 MP Desc. Top of Steel Meas. Date 10/26/83
Casing Time 1215Aquifer Alluvium

DEVELOPMENT DATA

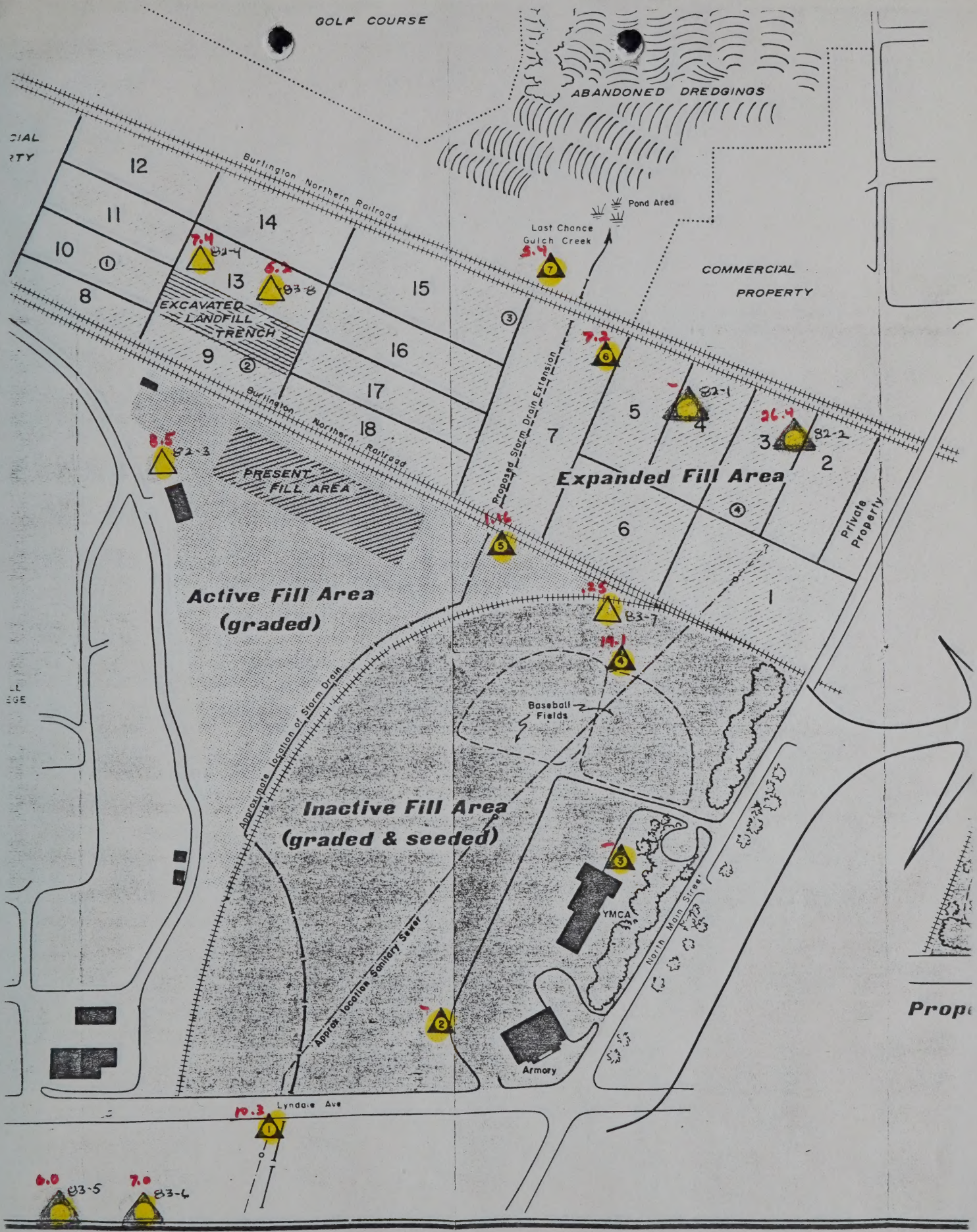
Date 10/26/83 Time Started 1215 Time Finished 1226 Total Development Time Est. Yield at Start 1-2 gpm Est. Yield at End 2-3 gpmEquipment: Bailer Sand Pump Compressor Surge Block Drilling
Hand (Other-Specify)Desc. of Equipment Hydrometrics Steel 3" 1.7 gal bailerDev. Additives Used Desc. of Packer & Surface Seals Water Color & Turbidity: At Start Muddy/grey At End Muddy/greyStatic Water Level: Time After Dev. Ended 1226 SWL 1585 Trend
After Development 1238 13.65Operator DRG WING Water Quality Samples Taken: Yes NoREMARKS: W.L. = 13.23 TD = 23.2 = 6 gals in one volume

WELL DEVELOPMENT LOG

Well No. 83-7WELL DATAPROJECT: Name City of Helena Landfill State MT County LICLocation: T R Sec. Tract Well Location (Narrative Desc.) Approx. 20 N. of Railroad spur north of
baseball diamondsWell Depth (Ft.) 37 Diameter (In.) 4.0 Perf. Interval Static Water Level 30.62 Above
Below 50.08 MP Desc. Top of steel Meas. Date 10/26/83
MP Casing Time 1245Aquifer AlluviumDEVELOPMENT DATADate 10/26/83 Time Started 1245 Time Finished Total Development Time Est. Yield at Start 1-2 gpm Est. Yield at End Equipment: Bailer Sand Pump Compressor Surge Block Drilling
(Other-Specify) Desc. of Equipment Hydrometrics 3" 1.7 gal bailer w/ tripodDev. Additives Used Desc. of Packer & Surface Seals Water Color & Turbidity: At Start Ext. high - brown w/ silt At End
& pebblesStatic Water Level: Time After Dev. Ended 1257 SWL 34.47 Trend Up 1.70 in 10 min
After Development 1307 32.77
1317 31.91Operator DRS, WC Water Quality Samples Taken: Yes NoREMARKS: Bailed 89 gals. Watched for recovery. Bailed 7, sampled

WELL DEVELOPMENT LOG

Well No. 83-8WELL DATAPROJECT: Name City of Helena - Landfill State MT County LSLLocation: T R Sec. Tract Well Location (Narrative Desc.) NE corner of active landfill siteWell Depth (Ft.) 60 Diameter (In.) 4.0 Perf. Interval 50-60Static Water Level 31.14 ^{Above}
Below TOPVC MP Desc. PVC TP Meas. Date 10/26/83
MP Time 1045Aquifer Alluvium - Landfill materialDEVELOPMENT DATADate 10/26 Time Started 1050 Time Finished 1120 Total Development Time 30 minEst. Yield at Start 1-2 gpm Est. Yield at End Equipment: Bailer Sand Pump Compressor Surge Block Drilling (Other-Specify)Desc. of Equipment Hydrometries 1 3/4 gal steel bailerDev. Additives Used noneDesc. of Packer & Surface Seals noneWater Color & Turbidity: At Start High / brown At End Med / brown w/ some siltStatic Water Level: Time After Dev. Ended 1122 SWL 46.73 Trend Up 6 ft in first 5 minOperator DRS, WLVC Water Quality Samples Taken: Yes NoREMARKS: Bailed 70 gals, waited 15 min, bailed 4 more gals, sampledDimensions of bailer
(2.2 x 5.35)5.35
2.2
1070
1070Bucket 1.92
w/water 1.66



NO₃+NO₂ (ppm)

10/24/83

ABANDONED DREDGINGS

12

Burlington Northern Railroad

Pond Area

Last Chance
Gulch Creek

COMMERCIAL
PROPERTY

8.3 (12/04)

EXCAVATED
LANDFILL
TREI

**Active Fill Area
(graded)**

**Inactive Fill Area
(graded & seeded)**

Baseball



Armory

Approx. location Sanitary Sewer

Lyndale Ave

23-5

83-4

Propo
$$NO_3 + NO_2 \text{ (ppm)}$$

6/30/82

Commissioners
Russell J. Ritter, Mayor
Rayleen Beaton
Michael J. DaSilva
Joan A. Duncan
Dale L. Johnson

Robert A. Erickson
City Manager



City-County Admin. Bldg.
316 North Park
Helena, MT 59623

Phone 406/442-9920

February 18, 1983

Mr. Duane L. Robertson, Chief
Solid Waste Management Bureau
Environmental Sciences Division
State of Montana
Room A201, Cogswell Building
Helena, Montana 59620

RECEIVED

FEB 23 1983

MONTANA DEPARTMENT OF HEALTH
AND ENVIRONMENTAL SCIENCES
SOLID WASTE SECTION

Subject: City of Helena Landfill Phase III

Dear Duane:

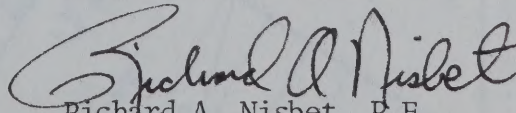
Transmitted herewith is a copy of the report prepared by Hydrometrics dated December 28, 1982 entitled "Drilling and Construction of Four Groundwater Monitoring Wells at the City of Helena Sanitary Landfill Helena, Montana".

This report summarizes the results of the logs of the four wells that were drilled as per our previous agreement and the water quality from the initial samples there were taken from the monitoring wells. As Mr. Botz indicates in his report, there is some degradation of the groundwater quality in these wells that is apparently due to some manmade occurrence upstream. It is hard to determine whether it is from the landfill or seepage from the storm drain and/or sanitary sewer main that traverses the upstream landfill sites.

The City of Helena is going to pursue the additional two wells upstream, as previously agreed, to determine what the quality of water is upgradient from the entire landfill site. I am not positive if we will be able to fund this in this year's budget but, in any case, we will be able to complete the groundwater test wells in next year's budget as previously agreed.

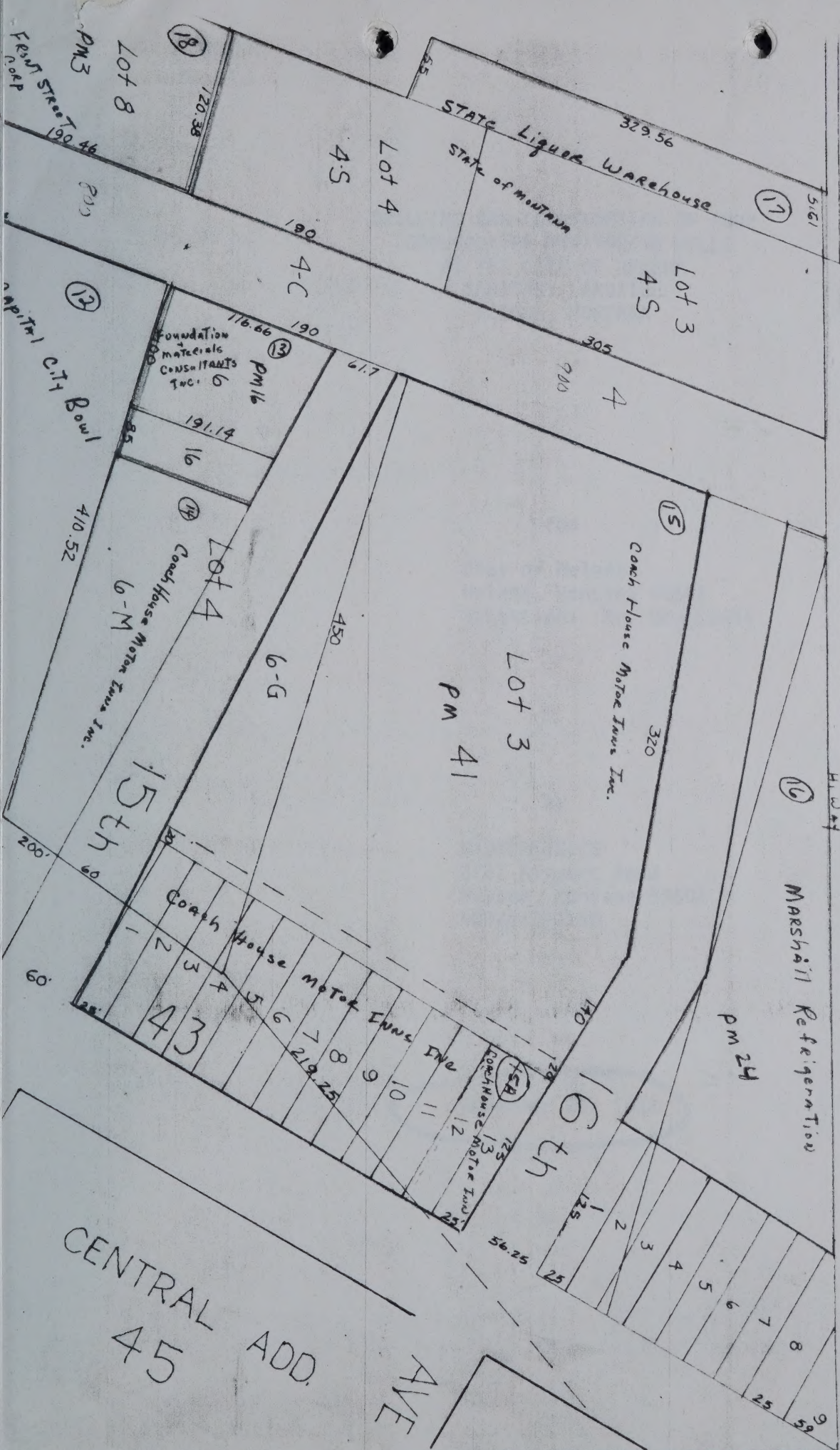
I am sorry you did not receive a copy of this report at an earlier date but I assumed that Max automatically sent you one for your reference. If you have any questions, please feel free to contact me.

Respectfully submitted,


Richard A. Nisbet, P.E.
Director of Public Works

RAN:cp
Attachment

cc: City Manager
Don Lewis, Superintendent of Sanitation/Shops



DRILLING AND CONSTRUCTION OF FOUR
GROUNDWATER MONITORING WELLS
AT THE CITY OF HELENA
SANITARY LANDFILL
HELENA, MONTANA

for

City of Helena
Helena, Montana 59601
Attention: Mr. Don Lewis

by

HYDROMETRICS
2727 Airport Road
Helena, Montana 59601
406/443-4150

December 28, 1982

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PLATE

PLATE 1. Plan Map of Helena Municipal Landfill Area Showing Monitor Well Locations.....	In Pocket
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DRILLING AND CONSTRUCTION OF FOUR GROUNDWATER
MONITORING WELLS AT THE CITY OF HELENA
SANITARY LANDFILL, HELENA, MONTANA

In the fall of 1982, the community of Helena began utilizing a new sanitary landfill area. This expanded landfill area is north of the Burlington Northern Railroad tracks and the active portion of this landfill area is located north of the scale house (Plate 1). The entire landfill area is expected to have an 18-year life beginning in fall 1982 with an annual average waste load of 35,000 tons per year (Don Lewis, pers. comm., August 1982). Landfilling activities in the expanded landfill area will use the presently excavated landfill trench and then will move westward to Area 1 along the east edge of the new landfill area (Plate 1).

A groundwater monitoring program has been developed by the City of Helena for the landfill area and this program has been coordinated with the Montana Department of Health and Environmental Sciences Solid Waste Management Bureau. The objective of groundwater monitoring is to determine hydrogeological characteristics of the landfill area and to provide groundwater quality monitoring that will detect adverse groundwater impacts created by the sanitary landfill.

The landfill area is in the lower end of Last Chance Gulch drainage and the ground surface slopes gently northward toward the Helena Valley. The west end of the landfill area is being used by Elk River Concrete products for storage of concrete culverts. Elk River Concrete is in

the process of phasing out their storage area. There have been previous technical evaluations of the Helena landfill area including a hydrological evaluation by Hydrometrics (June 1982); development of a groundwater monitoring program for the landfill (Hydrometrics, August 1982), and an evaluation of the soils in the landfill area (Hydrometrics, October 1982).

DRILLING AND CONSTRUCTION

The four monitoring wells were drilled and constructed by Lindsay Drilling of Clancy, Montana from November 26 to December 1, 1982. The driller used a forward rotary drill rig with a roller bit except for well 82-3, which required a down hole rock hammer. The holes generally were drilled with a 6-1/2 inch diameter bit to the total depth. Due to caving near the ground surface, a 7 inch OD steel casing was driven to prevent surface caving at each site. This casing has one-quarter inch thick walls and, where necessary, was welded using a triple pass weld. Generally, drilling conditions were difficult and many large rocks were encountered. Details of construction and the geological log of each well is in Appendix I. All drilling was directly supervised by an experienced hydrogeologist from Hydrometrics.

In monitoring well 82-1, the hole caved badly and could not be cased using plastic pipe. The plastic pipe had to be removed; the hole redrilled and 5 inch OD steel pipe driven. The other three wells were all cased with Class 160 PVC pipe. The pipe was slotted with vertical saw cut slots. These slots are approximately 6 inches long; have about 4 slots per foot and the slots are about 0.2 inches in width. In well 82-1, the steel casing had factory milled steel slots approximately 0.3

inches in width, 6 inches in length, and there are 3 slots per foot. Upon completion, a bentonite clay seal was placed at the ground's surface around the perimeter of each steel casing and each well was capped with an aluminum cap.

Well development was done by blowing the well with compressed air from the drilling rig until the water began to "clean up". The well was then cased and then bailed using a dart-type bailer until the bailed water had a low turbidity. All four monitoring wells produced a few gallons of water per minute. However, the yield of these wells is low and is less than needed for a normal household use.

GROUNDWATER

Groundwater in the vicinity of the Helene sanitary landfill occurs in unconsolidated alluvium in Last Chance Gulch and in bedrock beneath the alluvium. North of the landfill, groundwater also is present in consolidated bedrock of Tertiary geological age. As described in the previous report by Hydrogeologists (June 1987), groundwater probably flows in a complex path through these alluvial materials, with the general

GEOLOGICAL CONDITIONS

Hydrogeological conditions in the vicinity of the active landfill area have been described by Hydrometrics (June 1982). Generally, this portion of Last Chance gulch is an alluvium-filled valley bounded by igneous rocks along the west edge and underlain by limestone. The bedrock is overlain by unconsolidated to well-cemented alluvial materials derived from outwash from Last Chance gulch. The alluvial materials are heterogeneous and are composed primarily of silty, clayey, sandy gravels. There are some sandy zones and clay zones and some layers are well-cemented. Geological logs of the four test holes are in Appendix 1. These logs show the subsurface strata to be primarily sandy, silty gravels. Bedrock was encountered in well 82-3, which is near the equipment storage shed. At this location, limestone bedrock was encountered at 6 feet. Near the bottom of wells 82-1 and 82-2, cemented gravel layers or weathered bedrock was encountered. Drilling was hard and it was difficult to determine lithology due to material falling in from the sides of the borehole. The maximum depth of the alluvium at the landfill site is unknown. Based on drill holes north of the landfill area, the alluvium thickens considerably as it enters the Helena Valley.

GROUNDWATER

Groundwater in the vicinity of the Helena sanitary landfill occurs in unconsolidated alluvium in Last Chance Gulch and in bedrock beneath the alluvium. North of the landfill, groundwater also is present in semi-consolidated bedrock of Tertiary geological age. As described in the previous report by Hydrometrics (June 1982), groundwater probably flows in a complex path through these alluvial materials, with the general

direction of flow from south to north toward the valley. Groundwater was encountered in the four monitoring wells at depths ranging from 20.6 to 64.2 feet (Table 1).

A significant and unexpected finding of the monitoring well drilling program was the small amount of groundwater present in the alluvium and bedrock. Monitoring wells were drilled several tens of feet beneath the area groundwater table and the wells encountered only a few gallons of water per minute. The alluvial sands and gravels contained sufficient silt and clay to significantly reduce transmissivity of these materials. Although there probably are some channels or thin layers of relatively permeable sands or gravels, none were encountered during drilling. Recent monitoring well data, together with previous well information from the landfill site, suggests groundwater flow through the alluvium is relatively small.

GROUNDWATER QUALITY

On December 1, 1982, water quality samples were obtained from the four new monitoring wells. Samples were taken to determine the concentration of major anions and cations, nutrients and metals. All the wells were developed by Lindsay Drilling prior to sampling. Metal samples were filtered through a 0.45 micron filter immediately upon collection and were then acidified to a pH of less than 2. All samples were collected, preserved and stored in accordance with EPA recommended procedures and were analyzed in accordance with methods described in the EPA Manual of Methods for Chemical Analyses of Water and Wastes (1976) or the USGS Techniques of Water Resources and Investigations,

TABLE 1. SUMMARY OF DATA FOR MONITORING WELLS

<u>WELL NUMBER</u>	<u>TOTAL DEPTH BELOW GROUND SURFACE (ft)</u>	<u>INTERVAL PERFORATED BELOW GROUND SURFACE (ft)</u>	<u>STATIC WATER LEVEL BELOW MEASURING POINT (ft)*</u>	<u>CASING STICK-UP (ft)**</u>
82-1	40	14 - 34	20.6	1.6
82-2	43	23 - 43	23.4	1.5
82-3	83	43 - 83	64.2	0.9
82-4	79	44 - 74	60.0	1.5

* All water level measurements made on December 28, 1982. Measuring point is top of 7-inch OD steel casing (north side).

** Casing stick-up is the height of the casing top above ground surface.

Book 5, Chapter A-1. Analyses were done by Energy Laboratories in Billings, Montana, which is a certified laboratory.

Results of groundwater quality analyses are in Appendix II. These results show the water in all wells sampled is a calcium-bicarbonate-sulfate type, extremely hard, high alkalinity and near neutral pH. Total dissolved solids are moderate to moderately high and the nitrate plus nitrite concentrations are high. Except for iron and manganese in the sample from 82-1, metal concentrations are low. For the constituents tested, water from the monitoring wells meets Federal primary and secondary standards (Table 2) for public water supplies except for the following:

- 1) Iron and manganese in well 82-1 exceeds the Federal secondary drinking water standard.
- 2) Nitrate plus nitrite nitrogen in wells 82-1 and 82-2 exceed the Federal primary drinking water standard.
- 3) Total dissolved solids concentrations in 82-2 and 82-3 exceed Federal secondary drinking water standards.

Based on the chemical analysis, it appears that water quality in all the new monitoring wells has been influenced by man's activities. Results of chemical testing of older wells at the landfill showed groundwater quality in the landfill area similar to that measured by the four new wells (Hydrometrics, June 1982). Potential factors that could be degrading groundwater quality in the landfill area are:

TABLE 2
FEDERAL DRINKING WATER STANDARDS
FOR PUBLIC WATER SUPPLIES

<u>Parameter</u>	<u>Maximum Contaminant Levels for Inorganic Chemicals (mg/l)</u>
<u>Primary Standards</u> ⁽¹⁾	
Arsenic	0.05
Barium	1.
Cadmium	0.010
Chromium	0.05
Lead	0.05
Mercury	0.002
Nitrate as N	10.
Selenium	0.01
Silver	0.05
Fluoride	1.4 - 2.4 ⁽²⁾
<u>Secondary Standards</u> ⁽³⁾	<u>Recommended Maximum Contaminant Levels (mg/l)</u>
Chloride	250
Color	15 (color units)
Copper	1.0
Corrosivity	Non-corrosive
Iron	0.3
Manganese	0.05
Odor	Threshold odor number of 3
pH	6.5 - 8.5 Standard Units
Sulfate	250
Zinc	5.0
Total Dissolved Solids	500
Foaming agents	0.5

(1) 40 CFR Part 141 (Federal Register, Vol. 40, No. 248, December 24, 1975) and (Administrative Rules of Montana) ARM 16-2.14(10)-S14381.

(2) Maximum allowable concentration depends on annual average of maximum daily air temperatures at site of supply.

(3) 40 CFR Part 143 (Federal Register, Vol. 44, No. 140, July 19, 1979).

- 1) Development of leachate from the landfill and subsequent movement from the landfill into the groundwater system.
- 2) Seepage of water from the sanitary sewer and/or the storm drain that underlies portions of the landfill.
- 3) Movement of poor quality groundwater into the area from areas upgradient of the landfill.

Chemical analysis of water from monitoring well 82-2 shows the nitrate plus nitrite nitrogen concentration was 35 mg/l. This concentration is similar to that in domestic and municipal sewage. Other constituents in the water such as high concentrations of total dissolved solids, alkalinity and hardness also are typical of sewage. Groundwater from the other three monitoring wells also has elevated concentrations of nitrogen, hardness and alkalinity. These waters may be influenced by leachate from the landfill or poor quality groundwater from upgradient sources in Last Chance Gulch.

GROUNDWATER MONITORING PROGRAM

The four new monitoring wells described in this report are part of a comprehensive landfill monitoring plan of the city of Helena. This plan, prepared for the city by Hydrometrics in August 1982, included seven proposed new monitoring wells. Due to funding and site utilization considerations, four of these wells were drilled in the fall of 1982 and the remaining three will be drilled in spring 1983.

Locations of the four new monitoring wells are near the proposed locations (Plate 1). These wells, together with the seven previously constructed monitoring wells, provide a basic groundwater monitoring network for the new landfill area. The three monitoring wells to be drilled in the spring 1983 will provide additional groundwater information for the landfill.

In accordance with the monitoring plan, water levels in the new monitoring wells will be measured monthly and water quality samples collected semi-annually. After water level trends are determined, water level measurements may be less frequent.

Quality assurance in both water level measurements and water quality sampling will be maintained as outlined in the monitoring program (Hydrometrics, August 1982).

REFERENCES

Hydrometrics, August 1982. Groundwater Monitoring Program, City of Helena Sanitary Landfill, Helena, Montana. Private Report to City.

Hydrometrics, June 1982. Hydrologic Evaluation Helena Municipal Landfill, Helena, Montana. Private Report to Montana Solid Waste Bureau. Hydrometrics, October 1982.

Hydrometrics, October 1982. Soils Evaluation of the City of Helena Extended Landfill Area. Private Report to the City of Helena.

APPENDIX I

Sanitary Landfill Logs and Construction
Details for Monitoring Wells

Geological Logs and Construction Details for Monitoring Wells

Measuring Point
Description/Elevation: Top of 7-inch OD steel pipe MP Height Above (+) 1.6 ft.
or Below G.S.:
Well Annulus Backfilled with cuttings; Bentonite seal at top.
Completion Description: 7' of 7 inch steel casing left in ground.

Remarks: Hole caved badly. Couldn't case with PVC. Drove steel casing.

[illegible]

State: Montana County: Lewis & Clark Project: Helena Landfill Hole Name or Number: 82-2

Legal Location: T 10N R. 3W Sec. 19 Tract. DC Descriptive Location: About 400 feet east of Well 82-2

Recorded by: Bob Miller Date Hole Started: 30 Nov. 82 Date Hole Completed: 30 Nov. 82 Driller: Lindsay Drilling Company: Lindsay Drilling

Drill Method: Rotary Drilling Fluids Used: Air and Foam Pilot Hole Diameter: 6½ inches Reamed Hole Diameter: Not Reamed

Total Depth Drilled: 43 Total Depth Reamed: -- Total Depth Cased Below G.S.: 43 Diameter and Type of Casing: 4" ID PVC

Weight or Class Interval Perforated Target Packer Type and Neoprene
Gage of Casing: 160 or Screened Below G.S.: 23-43 Aquifer: Alluvium Depth Below G.S.: 22

	YES	NO
Well Developed?	X	
Well Test Pumped?		X
Water Samples Taken?		X
Material Samples Taken?		X
E - Logs?		X

Method Perforated or Screened:

☐ No casing in hole.

☐ Open bottom only.

☐ Slotted with Mill's Knife.

☐ Slotted with a torch.

☐ Screened by pulling casing.

☒ Saw cut

☐ Other (specify) _____

Static
Water Level: _____ Date: _____

Measuring Point
Description/Elevation: Top of 7" OD steel casing MP Height Above ^(±) 1.5
or Below G.S.: _____

Well Annulus Completion Description: Drove 7 inch OD steel to 23 feet. Bentonite seal at ground surface.

Remarks: Cap on bottom of PVC.

[illegible]

Helena, Mt.

From	To	DRILLING LOG	Geological, Drilling, and Water Conditions and Sampling
0	6	Gravel, sandy, silty.	
6	10	Limestone, gray; med. hard, change to air hammer.	
10	31	Limestone, weathered; rust-colored zones; dry.	
31	45	Limestone, gray, hard, dry.	
45	47	Clay, red-brown, decomposed limestone? moist.	
47	83	Limestone, gray, hard with thin layers of red-brown clay at 55 and 60 feet. Moist below 61 feet.	
		Hole blows about 3 qpm at bottom.	

Helena, Mt.

State: Montana County: Lewis & Clark Project: Helena Landfill Hole Name or Number: 82-4

Legal
Location: T 10N R. 3W Sec. 19 Tract. CC Descriptive
Location: Just North of Active Fill Cell
Max
Recorded by: Botz Date Hole Started: 1 Dec. 82 Date Hole Completed: 1 Dec. 82 T. Drilling
Driller: Lindsay Company: Lindsay Drilling

Drill Method: Rotary Drilling Fluids Used: Water Pilot Hole Diameter: below 55' Reamed Hole Diameter: 6 1/2 inches Not Reamed

Total Depth Drilled: 79' Total Depth Reamed: -- Total Depth Cased Below G.S.: 78' Diameter and Type of Casing: 4-inch PVC

Weight or Class Interval Perforated Target Packer Type and Neoprene
Gage of Casing: 160 or Screened Below G.S.: 44-74' Aquifer: Alluvium Depth Below G.S.: 43

	YES	NO	Method Perforated or Screened:
Well Developed?	<u>X</u>	<u> </u>	<u> </u> No casing in hole.
Well Test Pumped?	<u> </u>	<u>X</u>	<u> </u> Open bottom only.
Water Samples Taken?	<u> </u>	<u>X</u>	<u> </u> Slotted with Mill's Knife.
Material Samples Taken?	<u> </u>	<u>X</u>	<u> </u> Slotted with a torch.
E - Logs?	<u> </u>	<u>X</u>	<u> </u> Screened by pulling casing.
Static			<u>X</u> Saw cut
Water Level: _____		Date: _____	<u> </u> Other (specify) _____

Measuring Point
Description/Elevation: Top of 7 inch OD steel casing. MP Height Above (+) or Below G.S.: 1.5

Well Annulus
Completion Description: 7 inch OD steel driven to 22 feet. Bentonite seal at top.

Remarks: Cap on bottom of 4 inch PVC.

[illegible]

LABORATORY REPORT

Lab. No. 82-1256

to Washington Date 12-17-82
111 Airport Road Bellevue, NE 68005

SPECIAL WATER ANALYSIS

Water Sampled: 12-17-82
 Sampled 12-17-82 by 12-17-82
 Sample Submitted 12-17-82

CONCENTRATION

mg/l

APPENDIX II

Water Quality Data for Samples from Monitoring Wells

Field No.	8
Station	73
Location	75
Depth	47
Surface	105
Color	40
Alkalinity	271
Hardness	9
Total Dissolved Solids	410
Total Solids as CaCO ₃	381
Total Suspended Solids	482
Dissolved Solids at 25°C	817
pH	7.1
Storage plus Nitrite	15
Ammonia Nitrogen	10
Volatility	700
Temperature (lab)	5 °C

WATER QUALITY

mg/l

mg/l

Cadmium	0.001	Lead	0.01
Copper	0.01	Fluoride	0.75
Iron	0.01	Chloride	11.01

LABORATORY REPORT

Lab. No. 82-7208

To Hydrometrics

Date 12-17-82 CB

Address 2727 Airport Road Helena, MT 59601
SPECIAL WATER ANALYSIS

Helena Landfill 82-1
Sampled 12-1-82 @ 09:40
Sample Submitted 12-1-82

<u>CONSTITUENT</u>	<u>mg/l</u>	
Potassium -----	3	
Sodium -----	23	
Calcium -----	90	
Magnesium -----	45	
Sulfate -----	194	
Chloride -----	40	
Bicarbonate -----	221	
Carbonate -----	0	
Total Hardness as CaCO ₃ -----	410	
Total Alkalinity as CaCO ₃ -----	182	
Total Dissolved Solids -----	483	
Specific Conductance @ 25°C -----	822	micromhos/cm
pH -----	7.1	
Nitrate plus Nitrite as N -----	11.9	
Chemical Oxygen Demand -----	10	
Turbidity -----	760	N.T.U.
Temperature (lab) -----	5	°C

METALS (Dissolved):

	<u>mg/l</u>		<u>mg/l</u>
Cadmium -----	0.001	Lead -----	<0.01
Copper -----	<0.01	Manganese -----	0.24
Iron -----	0.88	Zinc -----	<0.01

LABORATORY REPORTLab. No. G-82-7209To Hydrometrics Date 12-17-82 CBAddress 2727 Airport Road Helena, MT 59601SPECIAL WATER ANALYSIS

Helena Landfill 82-2
Sampled 12-1-82 @ 10:10
Sample Submitted 12-1-82

<u>CONSTITUENT</u>	<u>mg/l</u>	
Potassium -----	5	
Sodium -----	24	
Calcium -----	162	
Magnesium -----	52	
Sulfate -----	335	
Chloride -----	34	
Bicarbonate -----	263	
Carbonate -----	0	
Total Hardness as CaCO ₃ -----	618	
Total Alkalinity as CaCO ₃ -----	216	
Total Dissolved Solids -----	786	
Specific Conductance @ 25°C -----	1,160	micromhos/cm
pH -----	7.1	
Nitrate plus Nitrite as N -----	35.0	
Chemical Oxygen Demand -----	18	
Turbidity -----	50	N.T.U
Temperature (lab) -----	5	°C

METALS (Dissolved):

	<u>mg/l</u>		<u>mg/l</u>
Cadmium -----	0.001	Lead -----	<0.01
Copper -----	<0.01	Manganese -----	0.03
Iron -----	0.14	Zinc -----	<0.01

LABORATORY REPORT

To Hydrometrics Lab. No. 82-7210
Date 12-17-82 CB
Address 2727 Airport Road Helena, MT 59601

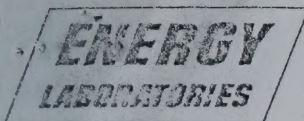
SPECIAL WATER ANALYSIS

Helena Landfill 82-3
Sampled 12-1-82 @ 09:00
Sample Submitted 12-1-82

<u>CONSTITUENT</u>	<u>mg/l</u>	
Potassium -----	6	
Sodium -----	49	
Calcium -----	175	
Magnesium -----	60	
Sulfate -----	190	
Chloride -----	44	
Bicarbonate -----	605	
Carbonate -----	0	
Total Hardness as CaCO ₃ -----	682	
Total Alkalinity as CaCO ₃ -----	496	
Total Dissolved Solids -----	840	
Specific Conductance @ 25°C -----	1,320	micromhos/cm
pH -----	6.8	
Nitrate plus Nitrite as N -----	8.9	
Chemical Oxygen Demand -----	14	
Turbidity -----	86	N.T.U.
Temperature (lab) -----	5	°C

METALS (Dissolved):

<u>mg/l</u>	<u>mg/l</u>
Cadmium ----- <0.001	Lead ----- 0.01
Copper ----- <0.01	Manganese ----- <0.02
Iron ----- <0.03	Zinc ----- 0.01



ENERGY LABORATORIES, INC.

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LABORATORY REPORT

Lab. No. 82-7211

To Hydrometrics

Date 12-17-82 CB

Address 2727 Airport Road Helena, MT 59601

SPECIAL WATER ANALYSIS

Helena Landfill 82-4
Sampled 12-1-82 @ 10:50
Sample Submitted 12-1-82

<u>CONSTITUENT</u>	<u>mg/l</u>	
Potassium -----	3	
Sodium -----	27	
Calcium -----	103	
Magnesium -----	30	
Sulfate -----	132	
Chloride -----	37	
Bicarbonate -----	271	
Carbonate -----	0	
Total Hardness as CaCO ₃ -----	379	
Total Alkalinity as CaCO ₃ -----	222	
Total Dissolved Solids -----	460	
Specific Conductance @ 25°C -----	778	micromhos/cm
pH -----	7.5	
Nitrate plus Nitrite as N -----	8.3	
Chemical Oxygen Demand -----	13	
Turbidity -----	44	N.T.U.
Temperature (lab) -----	5	°C

METALS (Dissolved):

	<u>mg/l</u>		<u>mg/l</u>
Cadmium -----	0.002	Lead -----	<0.01
Copper -----	<0.01	Manganese -----	<0.02
Iron -----	<0.03	Zinc -----	<0.01

LABORATORY REPORT

Lab. No. 82-7210

To Hydrometrics

Date 12-17-82 CB

Address 2727 Airport Road Helena, MT 59601
SPECIAL WATER ANALYSIS - Duplicate Results

Helena Landfill 82-3
Sampled 12-1-82 @ 09:00
Sample Submitted 12-1-82

CONSTITUENT	Original mg/l	Duplicate mg/l	
Potassium -----	6	6	
Sodium -----	49	49	
Calcium -----	175	180	
Magnesium -----	60	60	
Sulfate -----	190	186	
Chloride -----	44	43	
Bicarbonate -----	605	610	
Carbonate -----	0	0	
Total Hardness as CaCO ₃ -----	682	696	
Total Alkalinity as CaCO ₃ -----	496	500	
Total Dissolved Solids -----	840	848	
Specific Conductance @ 25°C -----	1,320	1,320	
pH -----	6.8	6.8	
Nitrate plus Nitrite as N -----	8.9	9.1	
Chemical Oxygen Demand -----	14	14	
Turbidity -----	86	88	N.T.U.
Temperature (lab) -----	5 °C		

METALS (Dissolved):

	mg/l	mg/l		mg/l	mg/l
Cadmium -----	<0.001	0.001	Lead -----	0.01	<0.01
Copper -----	<0.01	<0.01	Manganese -----	<0.02	<0.02
Iron -----	<0.03	<0.03	Zinc -----	0.01	0.02

